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THE UNIVERSITY OF ALBERTA

A CRITICAL SURVEY OF THE CONCEPT OF MECHANICAL
AND TELEOLOGICAL CAUSALITY IN THE HISTORY OF
PHILOSOPHICAL AND SCIENTIFIC THOUGHT

A DISSERTATION
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ABSTRACT

The concept of causality has always played a significant role in the history of scientific and philosophical thought.

The first important challenge to the traditional notion of the necessary connection between cause and effect was provided by Hume, who contended that causation involved nothing more than temporal succession. Hume declared that all our knowledge comes from experience, and it is obvious that experience does not provide us with any idea of necessity as such. According to Hume we derive our ideas concerning cause and effect from the 'habit' of seeing objects or events in constant conjunction. We conclude that the 'necessitarian' view of causation cannot be proved logically or empirically.

The views of Kant on causation are important, but unfortunately not too clear. He agreed with Hume that the 'necessitarian' view of causation could not be derived from experience by generalizing from the observation of particular instances. It was Kant's belief that the mind contains certain inherent principles which he calls 'categories' of which causality is one, which systematize and unify the objects of experience through the forms of space and time. These categories he considered as being a priori in the sense that without them a sensible world of experience would not be possible. He did not contend, of course that particular causal judgments were a priori. We cannot be certain that Kant believed in the necessary connection between cause and effect. It is clear that he did not consider that this 'necessitation' was of

logical implication, yet he frequently uses the term 'necessary' in connection with causal relationship.

We next examine in Chapter Four the three senses in which the term 'cause' can be used. The first sense of the term refers to effects brought about by a conscious and responsible agent. It should be noted here that 'cause' and 'motive' do not always coincide. The second sense of the term 'cause' is employed in the practical or applied sciences. Here to discover the cause of an event means to find out what needs to be altered if we are to produce, prevent, or counteract it. We notice here that the terms 'reason' and 'explanation' do not necessarily imply causation. The third sense of the term applies to the theoretical sciences such as physics or chemistry. The rationalist would say here that there is a 'necessary' connection between cause and effect; whereas the 'regularity' theorist contends that nothing beyond temporal sequence is involved. Actually the term 'cause' as it is usually used has little significance in the theoretical sciences, because relationships here can be adequately explained on the basis of laws in which the notion of cause does not appear.

The advent of quantum mechanics would appear to demonstrate that the electron is not subject to the laws of cause and effect. Contrary to the opinions of some writers, the so-called Principle of Indeterminacy does not discredit the principle of causality as such. The fact that statistical probability rather than causality apply to the behavior of the electron does not prove that causality thereby is invalid in other instances. There is an essential difference between the mathematical

and causal relationship. There is logical necessity in mathematics, not so in causality. The connection between cause and effect may be described as necessary, but it is not logical necessity.

Statistical laws of probability are employed when the individual elements do not lend themselves to causal explanation. This does not mean that the elements are thus necessarily undetermined. Insurance mortality tables do not contradict the assumption that each individual life span is completely subject to rigid laws of cause and effect.

Probably the basic controversy concerning causality stems from interpreting the causal relation as being either mechanical or teleological. Actually there should be no conflict because the notions are not mutually exclusive. Mechanical explanation does not preclude purposiveness. Also the problem of determinism arises as much for the teleologist as it does for the mechanist. The behavior of the electron may be undetermined, yet that does not necessarily make it purposive or teleological.

It would appear that the notion of causality is still a vital part of our epistemology despite severe criticism as a result of new developments.

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CHAPTER ONE

INTRODUCTION

In the history of scientific and philosophical thought, the concept of causality has been of paramount importance, and particularly since the advent of the modern period in science and philosophy, it has been the centre of considerable controversy, which has become especially acute since Heisenberg formulated his so-called Principle of Indeterminacy, earlier in this twentieth century. Almost as early as the birth of philosophy, however, there is already evidence of a radical divergence of opinion concerning this subject. On the one hand, the atomists Democritus and Leucippus developed the mechanistic viewpoint, whereas Plato and his famous pupil Aristotle on the other hand, emphasized the teleological aspect of nature. As a matter of fact it might reasonably be contended that one of philosophy's most profound problems involves the notion of cause, i.e. the ultimate origin of nature.

After all the thought that has been brought to bear on the subject, one might reasonably assume that the problem of causation would be nearer to a solution; unfortunately, however, such is not the case. Thus it is that nowadays it is not merely the problem itself that is subject to controversy, but even the very basic ideas involved in it are being questioned. Thus, if anything, the question of causality has become more involved and confused.

It may be contended that controversy and even confusion

are not new to science, and especially to philosophy, and consequently there is no reason to be unduly perturbed. However, as this thesis will endeavor to indicate, the nature of the cleavage is so basic, and its consequences so far-reaching, that there would appear to be an urgent need for a more unified and consistent philosophy pertaining to causality, a principle traditionally considered to be of the utmost basic significance to both theoretical and practical scientific knowledge. Aristotle even identified wisdom with the knowledge of causes. "Clearly then, Wisdom is knowledge about certain causes and principles."¹ Here, for example, in the words of Max Planck, is the difference it makes to science. "..... if it did not affect our approach to physical science, physicists as such would not have to concern themselves with the matter. But the controversy now affects the very basic method on which scientific research is carried on. If the basis of causation be not valid, then how can the decisions arrived at on this basis be considered reliable? Therefore, the controversy affects the general claim to reliability which natural science puts forward."²

The issue is of equal significance in the field of philosophy. For example, our notions of the nature of causality will determine our attitude towards ethics and justice, since this concept is so intimately associated with determinism and the idea of moral

1 - Metaphysica, 982a, Works of Aristotle, Vol.8, Translated by J.A. Smith and W.D. Ross.

2 - Where is Science Going? p.110.

responsibility. By and large the philosophy underlying our criminal law is that, because the culprit has a free will, he deliberately chooses evil, and thereby incurs and is deserving of the proper punishment; whereas, the increasing popularity of the idea of reform in penal circles must have as its philosophical basis the assumption that the behavior of the offender is determined to a greater or lesser extent and this of course decreases the emphasis on personal culpability, and directs the emphasis on the modification of contributing factors, both constitutional and environmental.

The concept of causality is also of tremendous importance in the field of human illness - both physical and mental. The nature of the cause of the disease is of paramount significance to medicine. It is obvious even to the layman that the type of therapy prescribed will depend upon what is considered to be the cause of the ailment. At one time physical disease was considered to be caused by antecedents that were exclusively physical. The remedies would be appropriate to this basic assumption. Currently, however, the trend is towards what is called 'psychosomatic' medicine. It is still recognized that some disabilities have predominantly physical causes, but there is an increasing amount of evidence to show that a considerable portion of physical illness cannot be explained in terms of physical factors. Now, even if it is claimed that emotions are strictly physical phenomena, the point still remains that a change in view as to the nature of the cause, will make a corresponding difference in the remedial measures applied.

There are still other points of view. Possibly these are sufficient to demonstrate the great difference it makes theoretically and practically as regards what views are held concerning the nature of the cause in this field, not only in therapy but also in research.

Other illustrations could be cited to demonstrate further the importance of this issue. At any rate, we cannot escape the fact that clarification is necessary, and effort should be exerted in that direction, both for the sake of science and philosophy.

The nature of the cause would seem to be one of the significant aspects of the entire causal concept, though it is not the fundamental one. As we shall subsequently attempt to show, the essential problem concerns the nature of the connection between cause and effect. Specifically the controversy is between what might be called the 'regularity' theorists and the 'necessitarians', the former contending that the causal idea involves nothing more than regular temporal sequence, and the latter contending that there is an element of 'compulsion' or 'necessity' in the relation between antecedent and consequent. There are of course many other aspects of the case to which reference will be made.

Before we become too concerned, however, as to the importance of the nature of causality, we must attempt to establish first whether or not it has been and continues to be a valid and indispensable instrument in our interpretation of natural phenomena. Is the concept of the cause and effect relationship the most accurate explanatory device of most of our experience at least? If we are to proceed any

further and discuss and analyze the nature of the principle, we must first establish that the principle of causality, at least in one form or another, is generally accepted as an important part of our equipment in the acquisition of knowledge. It would seem to possess this general acceptance as such, possibly because its denial entails very serious implications. "We can scarcely deny the charge that in abolishing the criterion of causality, we are opening the door to the savage's demons."¹

Responsible thinkers have, from the very beginning strongly maintained that chance does not play any dominant role in the operations of nature. Aristotle left no doubt as to his views on the matter. "Certainly the early physicists found no place for chance among the causes which they recognized - love, strife, mind, fire or the like."²

Francis Bacon wished to eliminate the word "chance" from the vocabulary of science. "Chance is the name of a thing that does not exist."³

With the possible exception of the problem of the first cause, such has been and continues to be, by and large, the prevailing line of thought.

Not only on the basis of the above, but also on the basis of other overwhelming evidence, it would seem that nature is fundamentally

1 - Eddington, The Nature of the Physical World. p.309.

2 - Physica, Translated by R.P. Hardie & R.K. Gaye, p.196.

3 - Novum Organum, i. 60.

constructed on orderly and systematic lines. There would also seem to be rather general agreement that the concept of causality is involved to a considerable extent in the explanation of the nature of this order. The fundamental question with respect to the concept of causality would then be as aptly expressed by Sellars: "It is the kind of causality, not the absence of causality which is in question."¹

Of course it should be pointed out immediately that the latest formulations of quantum mechanics would appear to demonstrate quite definitely that the concept of causality is not applicable to the ultimate constituents of matter. This of course is no argument therefore, that causality does not apply to macroscopic physics, as well as other natural phenomena. We can probably then continue to maintain that the chief question surrounding causality concerns its nature rather than its absence.

Our purpose then in the first three chapters will be to examine the concept of cause and effect as such, and indicate by what means it might validly be derived. With regard to the latter, we are first confronted with the very significant skepticism of Hume who maintained that causality involved nothing more than temporal succession, and declared that the expectation of an effect from a cause was merely an association of two events based on habit. It is our opinion that he was successful in demonstrating that the idea of necessity in causality cannot be proved. In any case necessity or compulsion would not be the characteristic feature. An examination of the question of the deriv-

1 - Evolutionary Naturalism, p.244.

ation of the principle finally leads us to the conclusion that it cannot include more than is contained in the following: "Wherever questions are asked about causes, some event, which may matter to us or may not, has a spotlight turned on it: the investigation of its causes is a scrutiny of its antecedents in order to discover what would have to be different for this sort of thing to happen otherwise - what the antecedents God or man would need to manipulate in order to alter the spotlighted event."¹

In Chapter Three, Kant fails to convince us that causality is a category of the mind.

Quantum mechanics with its so-called Principle of Indeterminacy probably constitutes the most significant challenge so far to the universal application of causality. We notice, however, that 'indeterminacy' in the electron, does not necessarily prove the absence of causal connection in macroscopic phenomena. This leads us to an examination of the statistical interpretation of the undetermined electron, as well as group phenomena which involve elements whose individual behavior cannot be precisely predicted.

The next portion of our discussion concerns the relative merits of interpreting the cause and effect relationship as being mechanical or teleological as applied chiefly to biology and psychology. We have occasion here to trace briefly a historical survey of the manner in which these opposing points of view have clashed in the past and continue to do so. The alleged conflict between mechanical and teleological

1 - Stephen Toulmin, The Philosophy of Science, p.120.

causality probably constitutes the fundamental issue of this investigation. Here we shall endeavor to point out that this conflict in many respects is more apparent than real.

It is probably unnecessary to mention that all phases of the concept of causality cannot be exhaustively scrutinized in the limited scope of a thesis such as this. It was necessary therefore to be selective as to the choice of material to be included. For example, it was necessary to devote but cursory attention to the rather important question of the first cause of the universe as a whole. Other problems, though significant, of origin, such as that of organic matter, could not be included at all. It is hoped however, that at least some of the more essential implications of the principle of causality have been touched on.

CHAPTER TWO

THE SKEPTICISM OF HUME

The first really significant challenge to the validity of the principle of causality as it was regarded up to that time, came from Hume. According to his epistemology, the cause and effect relationship could not be a legitimate object of knowledge, but at best a matter of belief.

He was a thorough-going empiricist and like Locke maintained that all knowledge begins with experience, the bases of which are sense-data which he called 'impressions'. A mental image, the sort of perception which represents a sensation in memory or expectation, is an 'idea'. Hume is not too clear on the distinction between the two, but says that the former are the origin of the latter, and enter the mind with greater force and vivacity. These impressions and ideas when organized in accordance with psychological laws of association constitute the world we know. Ideas are faint images or copies of impressions to which they correspond and to which they must, accordingly, be referred for their explanation. It is, therefore, for Hume a fundamental principle that the explanation of any idea involves the necessity of tracing it back to the original impression from which it is derived.

We can see now that Hume's difficulty with 'cause and effect' is that it lies 'beyond the immediate impressions of our memory and senses.' Thus the whole basis of the idea is to be traced to the repetition of impressions. In other words, this notion must be a sense-datum in the

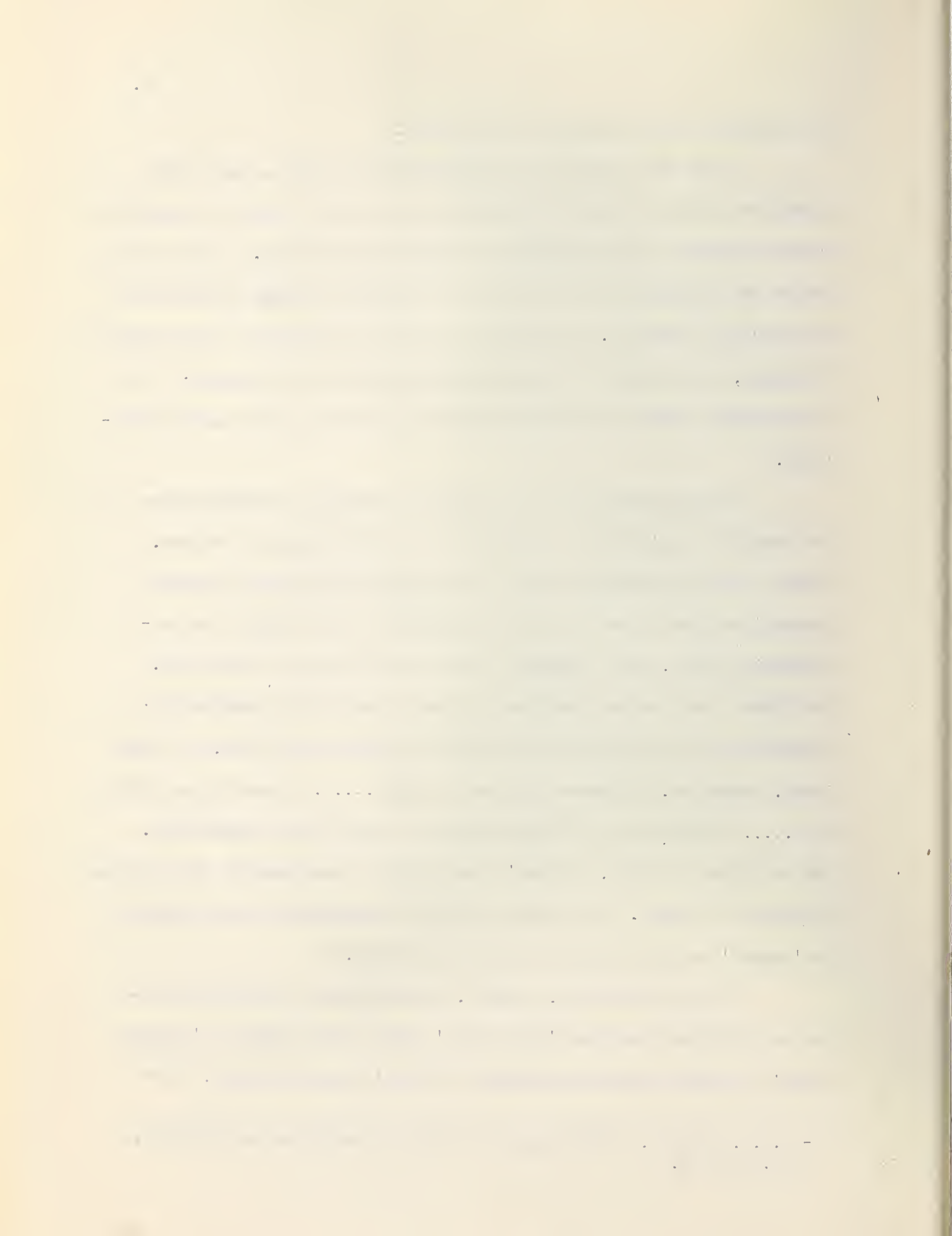
last analysis and obviously it is not that.

With the exception of mathematical principles, Hume could recognize neither the law of causality nor any other scientific generalization because he could discover no impressions of them. Hume readily admits the significance of the role of causation in human intellectual and practical endeavor, not because this idea was immanent in the nature of things, but because our experience has shown it to be useful; but it definitely "does not furnish us with the grounds of any certain knowledge."

Hume declares that the belief in causality is derived from the frequent repetition of the union of any two objects or actions. "There is no difficulty in seeing how repeated contiguity of similar impressions gives rise to a strong associative link between the corresponding ideas, and a tendency to pass from the one to the other. The flame I see revives the ideas of past flames which resembled it; these were all spatially and temporally contiguous with heat, and their ideas, therefore, introduce the idea of heat It soon happens that the impression of a flame evokes the idea of heat immediately. The two ideas are then, in Hume's terminology, associated by the relation of cause and effect. It is this automatic association which enables us to 'reason' on the relation of cause and effect."¹

On his own theory, however, the question of repetition cannot be significant because 'repetition' stands with regard to 'impressions' in exactly the same position as does 'cause and effect.' How

1 - D.G.G. Macnabb, David Hume, His Theory of Knowledge and Morality, pp. 65 - 66.



can Hume talk about 'repetition' of impressions when such a piece of information, on his own theory cannot be a sense-datum? He has confused a 'repetition of impressions' with an 'impression of repetition of impressions'. It would seem that Hume restricted the means of acquiring knowledge to such an extent that even he found it difficult to operate within the confines of his own theory.

Of course Hume might reply that there is a difference between repetition and causality. He might maintain that our notion of repetition is not an 'impression' but is derived from the fact that our memory enables us to visualize a number of similar instances. Hume attempts to provide this view with the validity of an impression by designating it as an "impression of reflection."¹ This difference is significant and well taken, though the argument would perhaps be stronger if 'repetition' was an actual impression.

For Hume there can be no inference to causality. When the mind passes from an idea or impression of one object to that of another, it is the imagination which is performing, not the understanding. It is custom and habit, and not reason that is at work. Custom and habit operate through the laws of association, and it is upon this associative union of ideas that the 'inference' rests. The inference is not determined by reason, since that would require us to assume order and uniformity in nature, which itself is not an impression and therefore not necessary but only "inferred" from experience in the Humian sense of the term.

1 - David Hume, A Treatise of Human Nature, Vol.1, Everyman Series, p.163.

Hume did admit the application of inference in mathematics as the only science "in which we can carry on a chain of reasoning to any degree of intricacy, and yet preserve a perfect exactness and certainty."¹ It would appear that this limitation of the process of inference to mathematics is at best arbitrary. Also, if an impression is the sole basis of knowledge, why exempt mathematics from this restriction? Since mathematical concepts are not sense-data, why should they be regarded as proper objects of knowledge?

We can see that on Hume's theory of knowledge, the question of how anyone's knowledge comes to extend beyond the range of his memory, remains unanswered. Inference in the logical sense is merely the work of fancy or imagination when applied to anything except mathematics. Restricting the acquisition of knowledge to experience alone involves serious implications. "Even on the most favorable interpretation, the most experience can teach us to expect is that something very like what we have previously experienced will come to pass; it can never lead us to infer the existence of a genuinely novel entity."²

This habit or custom of expecting an effect from a cause is reinforced by the fact that in any given case we expect the same sort of conjunction in the future. This expectation, however, at best is grounded only in belief. "For past and present experiences can bear witness only to the past and the present. In inferring to the future we are not merely following the guidance of experience, we are like-

1 - David Hume, A Treatise of Human Nature, Everyman Series, Vol.1, Book 1, Part III, Section 1.

2 - J.A. Passmore, Hume's Intentions, p.32.

The first part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The second part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The third part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The fourth part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The fifth part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The sixth part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The seventh part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The eighth part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The ninth part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself. The tenth part of the paper discusses the importance of the study of the history of the English language. It is argued that a knowledge of the history of the language is essential for a full understanding of the language itself.

wise, in addition presuming a resemblance between the objects of which we have had experience and those of which we have had none. The validity of the inference is the validity of the presumption; and when we ask for evidence of the truth of the presumption, neither reason nor experience can be of any avail. Reason cannot aid us: it has no jurisdiction, and is therefore unable to operate, in respect of matters of fact and existence. Nor can experience help us; it can instruct us only in regard to the sheerly de facto; it is necessarily silent in respect of all that has not yet existed."¹

Cause and effect then can be explained by the psychological laws of association; the presence of one of two elements related in this manner will recall the other. "A cause is an object precedent and contiguous to another and so united with it that the idea of one determines the mind to form a more lively idea of the other."²

Thinkers prior to Hume had asserted that the concept of causality involved not only invariable temporal sequence, but also that there was an element of necessity or compulsion in the cause producing the effect. Necessity was considered to be the characteristic feature, the 'extra something' to distinguish a causal connection from mere temporal contiguity. This was the focal point of the Humian scepticism. He rejected the foundation of the idea of logical necessary connection, because for him it could not be a legitimate object of knowledge.

It should be noted however, that laws of association per se

1 - N. Kemp Smith, The Philosophy of David Hume, p.374.

2 - Hume, A Treatise of Human Nature, Everyman Series, Vol.1, p.167.

will not give us a basis for distinguishing between post hoc and propter hoc and Hume recognized this. How do I establish the difference? How do I distinguish between those temporal antecedents of an event which are its causes, and those which are not? I repeat the experiment and if the same sequence of events recurs, I conclude that it was a causal and not an accidental sequence. In a billiard game the reason I believe that the movement of the ball was caused by the impact of another ball, rather than by someone lighting a cigarette at the same time, is that from experience I know that balls always move when struck by other balls moving quickly, whereas they do not move when cigarettes are lit in their vicinity. The presence or absence of causality in any specific situation then, must be established empirically. In other words, Hume accepted the empiricist answer to the necessitation question: 'necessitation' means observed uniformity of conjunction.

This is opposed to what might be described as the rationalist view. Cause and effect here is a logical relation of ground to consequent. The implication is that if the cause is given not only does the effect follow, but also from the very thought of the cause the thought of the effect follows logically. Observation or experiment would not establish this relation, but merely confirm it. The necessary connection between cause and effect would be as inexorable and automatic as for example in geometry, where, if we know the length of two sides and the size of the included angle, we can precisely discern the third side.

It would probably be reasonable to contend that such a precise and direct view of causality would apply in few instances, because in

most cases contributing factors must be considered. It would appear that Collingwood represents much better thinking on the subject when he asserts ".... the rationalist theory of causation.... cannot be regarded as an 'analysis' of the causal propositions asserted by natural science as it has existed for the last few centuries.... For no one believes that they can be established by sheer 'thinking,' that is, by finding the so-called effects to be logically implied in the so-called causes. It is just because this is impossible that the questions what causes a given effect and what effect a given cause produces have to be answered by observation and experiment."¹ Such a rationalistic viewpoint would have its basis in the intellectualist classical tradition. "The original impulse out of which the classical tradition developed was the naive faith of the Greek philosophers in the omnipotence of reasoning. The discovery of geometry had intoxicated them and its a priori deductive method appeared capable of universal application... Thus it came to be thought that by mere thinking the most surprising and important truths concerning the whole of reality could be established with a certainty which no contrary observations could shake.... Moreover it is still believed, except in Great Britain, that a priori reasoning could reveal otherwise undiscoverable secrets about the universe and could prove reality to be quite different from what, to direct observation it appears to be."²

But Hume is no supporter of what is usually meant by the

1 - Philosophical Essays, Vol.2, p.317.

2 - B. Russell, Our Knowledge of the External World, p.5.

'uniformity' view of causation. He is careful to insist that causation is more than sequence, even invariable sequence. Here we have it in Hume's words quoted from Kemp Smith: "Shall we then rest contented with these two relations of contiguity and succession, as affording a compleat idea of causation? By no means. An object may be contiguous and prior to another, without being consider'd as its cause. There is a necessary connexion to be taken into consideration; and that relation is of much greater importance, than any of the other two above-mention'd."¹ The problem confronting Hume is that of determining the character of this necessary connection, and the source of our idea of it.

Hume recognized that the concept of causality as it was ordinarily used implied the idea of necessary connection as its characteristic feature. This, on his theory of knowledge we have no way of knowing. According to him we arrive at a belief in this element of necessitation because of the cumulative effect upon the observer of the repetition of a cause and effect situation. This 'custom or habit', once generated, in turn so acts upon the observer of the repeated sequences, that there is produced a feeling or sentiment of being determined, that is necessitated, in the transition. "The idea of necessity arises from some impression. There is no impression conveyed by our senses which can give rise to that idea. It must, therefore, be derived from some internal impression, or impression of reflection. There is no internal impression which has any relation to the present business, but that propensity, which custom produces, to pass from an object to the idea

1 - N. Kemp Smith, The Philosophy of David Hume, p.92.

of its usual attendant. This, therefore, is the essence of necessity."¹ The 'impression', then, to which Hume thus traces the idea of necessity, is to be properly regarded as a feeling in the mind, not an apprehended relation between existents. "Necessity is something that exists in the mind, not in objects."² It is, therefore, not a matter of knowledge but a matter of belief. "What Hume has discovered is, to use a modern phrase, that a thought-factor enters into the constitution of experience and gives it unity and continuity in addition and in contrast to mere spatial and temporal relationships. It is additional to the data..... All conclusions derived from experience imply this thought-factor which enters into its constitution; they do not rest on any necessity or necessary relation between the objects; but the inference being the operation of the imagination itself, is what constitutes the necessity."³

R.G. Collingwood accepts Hume's views concerning necessitation. "I submit that we ought never to assert necessitations, but on the occasions when we do assert them we ought to be asserting something quite different, namely observed conjunction. Necessitation being again left undefined."⁴ The last statement may be somewhat unfortunate in that it would seem to imply that possibly the necessity is there, but is intangible, and therefore not readily enunciated.

Collingwood continues to present an interesting explanation

1 - David Hume, A Treatise of Human Nature, Everyman Series, Vol.1, p.163.

2 - David Hume, A Treatise of Human Nature, Everyman Series, p.163.

3 - B.M. Laing, David Hume, pp.129 - 130.

4 - Philosophical Essays, Vol.2, p.319.

of the derivation of the necessity idea. He says that its origin is anthropomorphic. "The idea of compulsion, as applied to events in nature, is derived from our experience of occasions on which we have compelled others to act.... Compulsion is an idea derived from our social experience, and applied in what is called a 'metaphorical' way."¹ This is an interesting appraisal of the matter, and probably contains a substantial element of truth. Another reason for attributing compulsion might be that this conclusion is almost irresistible in those cases where there are innumerable instances of the conjunction of the two factors or events.

The question might very well be raised that the theoretical or practical significance of the notion of necessitation applying inherently to existents, or being merely the result of habit is considerably overemphasized. It has, for example, been observed for a long time now, that under certain conditions, the tubercular bacillus will produce a disease called tuberculosis. The circumstances will vary but in each case the germ would appear to have to be present to cause the effect which is the disease. There is good reason to believe that this is the way it has always been, and that this particular relation will remain as long as we have the disease. As long as the foregoing statement is true, what possible difference could it make whether the connection between cause and effect involves inherent necessity, or whether this necessity is merely an inference on our part because we have observed so many instances of this particular antecedent and consequent? And

as long as the invariability of the sequence remains, there would seem to be no basis for deciding the issue as to which view of necessitation is valid.

It should be recognized of course that Hume's interpretation of necessity provides a convenient loophole in case the invariability of the sequence is in doubt or disproved. The inherent necessity view of course must assume a priori absolute invariability between cause and effect. The issue then would seem to revolve around the certainty of invariable concomitance. If the latter can be properly assumed with respect to any specific causal situation, then there would seem to be no valid reason against maintaining that necessity was intrinsic in the situation. Such an assumption would, it would seem, have to be vindicated empirically. Hume's scepticism would deny that we could ever obtain a sufficient number of invariable instances to establish the inherent necessity viewpoint. For Hume the number of instances would be of no consequence, as the presence of necessity could not properly be a matter of knowledge.

Might we not maintain then, that the question of intrinsic necessity has an empirical basis? The principle of causality per se would be a philosophical concept, but its relevance to any two events which can be designated as cause and effect, must be established empirically. The sceptic will say, as Hume did, that situations considered invariable today may prove to be otherwise in the future. Does this mean however that the actual relationship between antecedent and consequent has changed? Or rather is it that our knowledge

of the elements comprising the situation has increased so that we must change our minds with respect to the nature of the cause or the effect? Does this however invalidate the element of necessitation in a causal relationship? For example we used to have many queer ideas as to what produced a certain disease - ideas which would bear little resemblance to modern views. Does this actually mean however that the actual cause has changed in the interval? It would probably be reasonable to assume that though our knowledge of the nature of a cause is subject to continual change, the cause per se has remained constant in nature.

Even if it be assumed or even proved that causality involves an element of compulsion between cause and effect, this still does not mean that necessity is the characteristic feature of causality. We have necessity in mathematical relations but no question of causality. Hydrogen and oxygen under certain conditions combine to form water, yet again this is not a cause and effect connection; yet when the conditions are right the water is necessarily formed. We also have many examples of logical necessity; for example the principle of identity.

As a further argument against this view we have the fact that even a high correlation between two different phenomena does not always mean that they are directly or permanently related. For example, high rates of literacy and high rates of criminality may be closely correlated, yet neither may be the cause of the other - rather, both are caused by some factor such as predominantly urban living. Actually there is no a priori reason why even a 100% correlation should prove any causal relationship.

What then is the characteristic feature of the causal relation? Perhaps there is a special quality of dynamism between antecedent and consequent by which the former produces a new determination in the latter. If I push a door, it opens; it has assumed a new status, though perhaps not very significantly different from its former status. A better example might be a disease germ whose effect might produce very significant changes in all or parts of the body. It is doubtful, however, whether these possibilities imply any distinctly new elements beyond mere regular sequence.

It would be apparent that Hume has succeeded in demonstrating that experience cannot provide us per se with a notion of necessity in causality or any other generalization for that matter.

It would also seem that causality cannot be vindicated on the grounds of logical necessity because there is no difficulty in conceiving of events having no causes. I can think of my door opening of its own accord. This kind of seeming impossibility must be distinguished from logical impossibility such as the idea of a square circle. There are many examples also in literature where this concept is ignored. It is clear that the notion of strict causality is not an inherent necessity in the process of human thinking. As a matter of fact the construction of novel scientific hypotheses must occasionally require that the scientist imagine events and conditions of existence that are contrary to the causal principle.

Hume is not content with reducing the evidence of a causal connection to experience of frequent conjunction; he also contends that

such experience does not justify the expectation of similar conjunctions in the future. Thus, in the words of Russel, "If Hume's account of causation is the last word, we have not only no reason to suppose that the sun will rise tomorrow, but no reason to suppose that five minutes hence we shall still expect it to rise tomorrow."¹

Such a view of things would appear to remove the very foundations of scientific achievement based on our ability to predict new phenomena on the basis of established laws. He denies that science can progress toward an increasing number of instances corroborating a certain hypothesis. "From the mere repetition of any past impression, even to infinity there never will arise any new idea such as that of a necessary connection; and the number of impressions has in this case no more effect than if we confined ourselves to one only."²

Hume may be correct in asserting that the concept of causality may not provide us with a theoretical absolute certainty, but if there is a sufficient number of instances, it should bring the probability very close to the certainty, particularly if the significant conditions are controlled. How much doubt, for example, is there that a flame would not produce heat? In other cases of course, such certainty may just be an ideal, especially if the indispensable conditions are of a complex nature. But even here, surely it should be recognized that more and more corroborative evidence, the result of research under controlled conditions, should bring us closer to the realization of the ideal of establishing a

1 - Russell, Our Knowledge of the External World, p.221.

2 - Hume, A Treatise of Human Nature, Everyman Series, Vol.1, p.91.

definite connection between two events as cause and effect.

It would appear that Hume's scepticism is unrealistic. Granted that the road toward the acquisition of knowledge is rugged, surely the evidence is overwhelming that tremendous progress is possible. "While admitting that doubt is possible with regard to all our common knowledge, we must nevertheless accept that knowledge in the main, if philosophy is to be possible at all. The most that can be done is to examine and purify our common knowledge by an internal scrutiny, assuming the canons by which it has been obtained, and applying them with more care and with more precision... The philosophic scrutiny therefore, though sceptical in regard to every detail, is not sceptical as regards the whole. Universal scepticism, though logically irrefutable, is practically barren."¹

In view of the preceding discussion what conclusions with respect to causality might we reasonably be entitled to draw? In the first place it would seem that the main issue revolves around the issue that the connection between cause and effect is a necessary one. Hume demonstrated that necessitation cannot be derived from experience. We have also seen that it cannot be proved on the basis of logic. Can it then be inferred from the invariable relation of antecedent and consequent in numerous instances? It doesn't seem as if a decisive answer can be given to this question one way or another. The temptation to infer the element of necessity into the relationship is almost irresistible in those instances where on innumerable occasions a certain cause is

1 - B. Russell, Our Knowledge of the External World, pp. 66, 67.

followed by a certain effect, yet, as Hume justifiably pointed out, this in itself does not prove the necessity of the connection, though such could be the case. It is quite possible that nothing beyond uniformity or constant conjunction is involved, although in any case the difference between post hoc and propter hoc should be recognized.

The difference however between mere temporal sequence and causal sequence would seem to have its foundation in experience; it has to be established empirically; it has to be found out. It is not an a priori rationalist principle to which natural phenomena is supposed to conform. The empirical approach is particularly preferable in those cases where the antecedent and consequent are complex in nature, and where a direct relation between the two is obscured by the presence of complex contributing factors, as, for example would be encountered frequently in the science of medicine. In any case necessity is not the characteristic feature of causality, as it is inherent in other types of relation such as logic and mathematics.

What then is the characteristic feature of the causation idea? Is it invariable sequence? This would seem to be involved in most cases, but not in all. In many instances for example, it would be quite proper and in accordance with the facts to declare that the cause of death is pneumonia; still many patients recover from it.

It would seem that temporal sequence is not always involved either. For example, we can say that the attraction of the sun 'causes' the earth's motion in an elliptical orbit, yet the sun's attraction and the earth's motion are simultaneous.

More likely the characteristic feature is that the factor acting as a cause is considered that way because we are especially interested in it. We are interested in it especially because we assume that by producing, altering, or preventing this factor, we can bring about a desired effect. What caused the car accident for example? In this case it would be some factor such as speed which we are interested in preventing. The road engineer would be interested on the other hand in making alterations in highway construction which would help to prevent accidents - the desired effect.

We shall have occasion to examine this point further in Chapter Four.

CHAPTER THREE

CAUSALITY AS A CATEGORY OF THE MIND

Hume, as we have seen proved that the notion of necessary connection in causality cannot be proved empirically. We shall now consider an interesting alternative by the great German philosopher Kant who endeavored to show that it was a creation of the mind, and known a priori. Kant was at first under the influence of the Leibnitz - Wolfian rationalism, but as he himself informs us, he was awakened from his dogmatic slumber by the scepticism of Hume who, developing the empiricism of Locke to its logical conclusion, denied the possibility of arriving at universal and necessary principles in geometry, physics, and metaphysics. Hume did not convince Kant that such principles were beyond discovery, but he did convince him, however that they could not be ascertained by the method of empiricism, for experience being limited can therefore never warrant conclusions more comprehensive than itself. "Kant is right in holding that mere sense experience cannot give any knowledge; in order to give knowledge or even a judgment expressing opinion the material must be to some extent organized. We cannot have content without form, and this form cannot be discovered by merely receiving sense-impressions passively."¹ Kant advanced an alternative method which he called the transcendental method, which proceeded upon the assumption fundamental in Kantian philosophy that the mind itself contributes something to the determination of sense impressions, and

1 - A.C. Ewing, Idealism, p.74.

this hypothesis is the basis for a priori knowledge for Kant.

Kant maintained that pure thought as such depended exclusively on the principles of identity and contradiction, but from this he concluded that pure thought could yield only 'analytic' judgments which merely analyzed concepts but did not provide any new knowledge as did 'synthetic' judgments. It was obvious to him that the a priori inferences of mathematics did yield new knowledge, and also that a principle such as causality was synthetic, because the cause is different from the effect and consequently cannot be discerned by merely analysing the effect. He was thus compelled to the conclusion that neither the truths of mathematics, nor the principle of causality could be established by 'sheer' thought without reference to experience. At the same time he realized that these principles could not be developed empirically, that is by generalizing from the observation of particular instances.

Kant solved the problem in the following manner. He proceeded first to analyze experience into its constituent elements. These are first, sense-data, which are presented under the forms of space and time, and second, the 'categories' such as causality which are the forms the understanding employs to give unity to the sense-data so presented. Space and time were sensible and yet a priori, that is they had the quality of being perceptual, and yet were a priori in the sense that they were prior to all experience. They were presupposed in the process in which the mind constructs the world of outward experience. This enabled geometry to be both a priori and synthetic; synthetic because it was based on something sensuous, a priori because space was presupposed

in all outer experience, and therefore the objects of this experience had to conform to geometry if they were to be experienced at all.

The justification of the 'categories' though different, has a certain similarity. Kant says they are implied in the sensible intuition of time, being deducible from the very notion of any possible experience in time. The categories belong to the understanding and are the a priori forms in accordance with which it provides unity to the sense matter presented to it in space and time. It is to be emphasized that they are not conceptions derived from experience, but are prior to experience in the sense that they are the conditions of it. Upon their a priori character depends the validity of the general judgments which underly all empirical judgments. For example, the empirical judgment 'fire causes heat' presupposes the a priori judgment 'every event has a cause' - a judgment which expresses one of the laws of the mind's activity in the process of constituting the world it knows.

It must be remembered, however, that this solution of the problem, since it only justifies synthetic a priori judgments within experience, ipso facto forbids us to apply them beyond experience, or on Kant's view, to the world of things-in-themselves.

According to Kant we cannot know the real objective world of things-in-themselves. The external world as we perceive it through the refractive medium of the forms of space and time and the categories, is but an appearance of the 'noumenal' world as Kant called it. Now any form of idealism, even if it has reduced all judgments to assertions about our experiences, still has to recognize the distinction between mere illusion

and genuine perception, unless it is prepared to put the best established conclusions of science on the same basis as the fancies of children.

This distinction was important to Kant because he wanted to refute the Humian argument that causality involved nothing more than sequence. "... though we may call any idea an object of consciousness, that does not explain what we mean when we contrast a mere series of fancies which arise in our imagination with a real or objective succession of events. There is no way of distinguishing between an objective sequence and an arbitrary sequence so long as we confine our attention simply to the succession of states in consciousness."¹

Kant's distinction lies in the fact that certain sequences of representations are irreversible, and others we can take in any order we like. Now it would seem that irreversibility implies necessity, and a necessary sequence is one which is determined by the category of causality. This is for Kant a proof of causality. "One point is perfectly clear. Kant is arguing that if we are to distinguish the objective succession of events in the phenomenal world from the subjective succession of our ideas, we must regard the former succession as necessarily determined, that is to say governed by the law of cause and effect."² The irreversible representations of course would apply only to objects of genuine perception, rather than to objects of illusion or imagination and fancy.

In the case of genuine perception of physical objects my exper-

1 - J. Watson, *The Philosophy of Kant Explained*, p.201.

2 - H.J. Paton, *Kant's Metaphysic of Experience*, p.222.

ience proceeds according to certain laws which determine inevitably that I must have the experience in question. Thus in the first edition of the Critique of Pure Reason Kant says: "Everything that happens presupposes something which it follows in accordance with a rule."¹ In the second edition of the same work Kant is even more specific: "All changes occur in accordance with the law of connection between cause and effect."²

Kant's method of distinguishing between the subjective and the objective is open to criticism. In the first place, some illusions at least are as much determined as any perceptions. If I look at a stick in water I am just as much determined to see it bent as I am to see it straight when it is not in water. As we shall see later even the hallucinations of a psychotic state are now generally believed to be determined by causal laws. It is becoming increasingly well established that our psychological states are causally determined as well as the physical objects perceived by us. It would seem that the mere presence of causality cannot be enough to distinguish the physical from the psychological unless the latter is not subject to causality. In any case the foregoing discussion scarcely constitutes a proof for the validity of the concept of causality. In fairness to Kant it might be pointed out that since little was known about psychology in Kant's time, he would scarcely be expected to have been aware of any determinism in psychological states.

As we have already noted, the category of causality, as well as the other categories, according to Kant, can only be applied to phen-

1 - Henry Margenau, *The Nature of Physical Reality*, p.396.

2 - *Ibid*, p.396.

omena. Yet it would appear that despite this, Kant proceeds inconsistently to apply the categories to things-in-themselves. It would appear that this inconsistency follows necessarily from the very conception of things-in-themselves. To consider the world we know as the appearance of unknown things-in-themselves surely must imply the latter as the 'cause' of the appearance. It is true that Kant attributes to the mind certain constructive powers in the form of the categories, but the function of the latter presupposes that there are sensations already given which need to be systematized. It would appear to be obvious that these sensations would seem to be the way things-in-themselves initially affect the receptive, perceptual capacity of the mind in a causal fashion.

Actually, it would seem that the causal relation between noumena and phenomena should be inferred quite reasonably, unless Kant had succeeded in demonstrating that there was some special reason for limiting it to phenomena. Presumably Kant has not done this, at least in the opinion of Ewing. "Now Kant's line of argument does not provide any such ground, so far as I can see. If it is valid at all Kant has proved that 'all' judgments about events or objects in time presuppose the categories, and in that case if judgments about physical objects existing independently of us are held to be justified on other grounds they will also presuppose the categories."¹

It would be expected that the principle of causality should be of particular significance to Kant, not only because of the intrinsic importance of the concept, but also because it was in connection with

it that he was first aroused by Hume from his dogmatic slumber to which we have already referred. In view of this it would be expected that he give this matter clear, consistent and comprehensive treatment. Such apparently is not the case. Despite his great analytic powers he did not endeavor to clarify the meaning of the concept of causality in a manner to make it accessible to satisfactory treatment. This, of course, makes a satisfactory appraisal of his views that much more difficult.

It would seem from the previous statement of Paton that Kant believed in the 'necessary' connection between cause and effect. Now we have already seen in this chapter that for Kant, certain sequences of representations are irreversible and it would seem that this implies that we must be conscious of these representations as causally necessary in a sense which cannot be reduced to uniform sequence. Ewing produces further evidence to support this conclusion: "... his (Kant's) frequent application of the term 'necessary' to causation in cases where it can hardly mean merely that the abstract principle that every change has a cause must necessarily apply to all phenomena seems quite incompatible with a mere regularity view."¹

It should be mentioned of course that the irreversibility of the representations referred to before is not decisive proof that necessity is present in the relationship, though the temptation to draw this conclusion is obviously strong. As already pointed out in Chapter Two, even a decisive proof of the absolute invariability between two events, does not thereby connote necessity.

1 - A Short Commentary on Kant's Critique of Pure Reason, p.134.

If Kant is a 'necessitarian' it is certainly not in the logical sense of the term, where the effect is implied in the cause, and consequently can be deduced from it. He believed instead that all causal judgments are synthetic and only by experience can we establish a causal judgment in any particular instance. Kant would agree with Hume that a necessary sequence is not a deduction. Perhaps Kant meant that a necessary sequence is the type where we find it necessary to explain a later event with reference to an earlier one in order to have an intelligible experience at all.

In any event this renewal of the discussion concerning the controversy between the 'necessitarians' and the 'regularity' theorists again brings up the point that the importance of the issue is over-emphasized. Even if we have to be content with the 'regularity' view, because the other cannot be conclusively demonstrated, anyone should still grant that we had proved something very significant if we could prove that like events would always happen under like conditions, even though we had not proved causality in any sense of the term going beyond regularity. On this basis it should be obvious that most would agree that we had proved all that was needed for science. As we shall see in the next chapter, the presence of the term cause on the 'necessitarian' view is thus becoming increasingly rare in the physical sciences.

For Kant, as we have already noted, the categories of which causality is one, are not conceptions derived from experience but a priori conceptions or forms of unity which are prior to experience in the sense that they are the very conditions of it. Kant may be

right about the a priori nature of causality as a proposition though this view has been questioned. No causal principle which we can formulate is logically self-evident as we saw in Chapter Two. It would seem, for example, that the concept of causality does not possess the self-evident a priori certainty of the principle of identity or non-contradiction. Neither, as far as we can determine is it deducible a priori from any self-evident propositions.

Probably a more serious objection is the following enunciated by Henry Margenau: "In claiming it to be of a priori validity Kant was certainly wrong, since well established scientific relations of a causal sort have often been at the mercy of contingent fact and causality itself has been meaningfully questioned."¹ It would appear that Margenau is substantially correct on both these points. In the first place the concept of causality would seem to be at the mercy of contingent fact rather definitely, in the form of the latest formulations of quantum mechanics. We will avoid going into this now as it constitutes the content of Chapter Five. In the second place, as Margenau asserts, should one expect a priori principles to be questioned meaningfully. Surely there can scarcely be any doubt that this very thing has been done repeatedly. For example, whether or not we accept Hume's conclusions, we must admit surely that he meaningfully questioned the concept of causality.

This criticism against the a priori nature of Kant's categories might become less formidable if it is recognized that particular causal laws can be known only as the result of experience not a priori. "But

1 - The Nature of Physical Reality, p.396.

Kant is not arguing that because we must be able to judge any object under the form 'if A, then B', therefore every object must be governed by the law of cause and effect. On the contrary, the hypothetical form of judgment is for him an empty form awaiting an object; and what we now have to prove is that all objects given to us under the forms of space and time must have a characteristic which enables them to be judged by the hypothetical form of judgment. That characteristic is necessary succession, and the proof of necessary succession must be a proof independent of the form of judgment."¹ We have already noted how Kant attempted to provide the proof for the necessary succession.

It is true according to Kant that when we judge an event to be objective, our judgment presupposes that the event is governed by the general law of causality, and consequently its cause is to be found in 'some' previous event. The determination of this event or cause is a matter for science, and cannot be established a priori. Quite often we do not know what the cause is, but on Kant's view we do know that a cause exists and it is up to empirical knowledge to bring it to light. This point needs to be emphasized lest there is any inclination to attribute to Kant the belief that even particular causal judgments are a priori.

Another point that needs to be examined is how Kant concluded that a category such as causality was a priori to start with. We have already referred to this question earlier in the chapter. Was this derivation nothing more than a priori intuition? Now one might accept certain

1 - H.J. Paton, Kant's Metaphysic of Experience, p.223.

things as being intuitively certain as in certain principles of logic and certain analytic propositions. There would seem to be good reason for hesitation for such a ready acceptance of a synthetic judgment such as causality. Of course it is virtually impossible to refute anything that has its source in intuition, which per se precludes the need for any further explanation.

In conclusion, it would seem that Kant has failed to convince us that the concept of causality is an a priori principle intrinsic to the very constitution of the mind. He has also failed to demonstrate the validity of probably what has usually been regarded as the essential aspect of the concept - the notion that the cause 'necessarily' determines the effect, if we can be sure that he held this view.

CHAPTER FOUR

SOME GENERAL ASPECTS OF CAUSALITY

Probably one of the chief reasons for the ambiguity and confusion surrounding the cause and effect relationship is the fact that the terms 'cause' and 'effect' are used in various different senses, depending on the specific situation to which they are to be applied. Henri Bergson,¹ for example, distinguishes between three uses of the term 'cause', thus: "A cause may act by impelling, releasing, or unwinding. The billiard ball, that stubbs another, determines its movement by impelling. The spark that explodes the powder acts by releasing. The gradual relaxing of the spring, that makes the phonograph turn, unwinds the melody inscribed on the cylinder... What distinguishes these three cases from each other is the greater or less solidarity between the cause and effect... Only in the first case, really does cause explain effect; in the others the effect is more or less given in advance, and the antecedent involved is - in different degrees of course - its occasion rather than its cause."

This point regarding the degree of solidarity between cause and effect may be well taken, but it does not exhaust the possibility for ambiguity. R.G. Collingwood also discriminates - but with much more extensive analysis - between three different senses in which the terms 'cause' and 'effect' can be used. "Sense 1. Here that which is 'caused' is the free and deliberate act of a conscious and responsible agent, and

1 - Creative Evolution - Translated by Arthur Mitchell, p.73.

'causing' him to do it means affording him a motive for doing it."² In this case other words, such as 'making', 'persuading', and 'forcing', may be substituted for 'causing.' About a year ago, for example, the Liberal party made certain allegations against the party in power in the Alberta legislature. The effect of these charges was that a provincial election was suddenly called. This did not mean that the Liberal accusations 'caused' an election; on the contrary, no such effect was anticipated. It did mean that the premier, acting consciously and responsibly, decided to call an election. While it is clear that the connection between these two events was unmistakable and could even properly be described as causal, still it would not be using the word 'cause' in the same sense as in the case of a billiard ball causing another one to move.

It should also be recognized that an action's having a cause is not incompatible with its having a motive as Gilbert Ryle properly points out. "For example, a man passes his neighbor the salt from politeness; but his politeness is merely his inclination to pass the salt when it is wanted as well as to perform a thousand other courtesies of the same general kind. So, besides the question, 'for what reason did he pass the salt?' there is the quite different question, what made him pass the salt at that moment to that neighbor? This question is probably answered by 'he heard his neighbor ask for it' or 'he noticed his neighbor's eye wandering over the table' or something of the sort."² We can see that in this case the motive could scarcely serve as a cause, because, even if

1 - Philosophical Essays, Vol.2, p.285.

2 - The Concept of Mind.

this person did not possess the attribute of politeness, he would still probably have passed the salt in response to the neighbor's request, in which instance it is the actions of the neighbor that acts as a cause to the effect of passing the salt. It would appear, therefore, that 'cause' and 'motive' are not to be considered as synonyms.

There is a second sense in which the term 'cause' is employed. Here Stephen Toulmin gives expression to this point of view. "Developments which we are interested in producing, preventing or counteracting-- these are the typical sorts of things about whose causes we ask. Correspondingly, to discover the cause of one of these developments is to find out what it is that needs to be altered if we are to produce, prevent, or counteract it.... In each case, we speak of that as the cause which in the context would have to be, or have had to be otherwise, for the development on which our attention is focused to go differently."¹

This is the sense in which the term 'cause' is employed in the practical sciences of nature such as engineering or medicine where the main object is to enable man to extend his control over his environment. This sense of the term still expresses an idea relative to human conduct, because the cause is under human control which serves as a means whereby human beings can control that which is caused. Suppose that a research scientist alleged that he discovered the cause of cancer, but added that this discovery could have no practical application because the cause could not be produced at will. It would be justifiably pointed out in this case that the term 'cause' was not being used in the established sense which

1 - The Philosophy of Science, p.120.

it has in medical context.

A cause in this sense is conditional in that it does not produce the corresponding effect by itself. There must also be present certain indispensable conditions which Collingwood fittingly calls conditiones sine quibus non. I may press the starter of my car, but, among other things, unless the battery is in good condition, the desired effect is not likely to follow.

Ordinarily when people speak of a cause, they are using the word in the second sense, without realizing the great difficulty there is in such cases to state precisely what the cause is, although the effect might be quite obvious. As an illustration, let us consider a car skidding on a road. Did it happen because the road was slippery? Or was it because the corner was not banked? Was the speed too great? Or was it a question of the center of gravity of the car? Now it is very possible that all these considerations were pertinent, but what could we properly consider to be the 'cause'?

John Stuart Mill clearly understood the issues involved here. The antecedent, he thinks is always complex, and any one of the comprising elements is called a condition. What people normally consider to be a cause is one of these conditions, arbitrarily selected and dignified with the name that more properly belongs to the whole set of conditions.

Are these conditions as arbitrarily selected as Mill thought? Referring again to our example of the car skidding, the road engineer might say that the lack of a proper degree of banking was the cause. The automobile engineer might quite justifiably contend that a lower center

of gravity would have prevented the skid. The safety director might on the other hand put the spotlight on speed. It would seem that the decision as to what is the cause is not entirely arbitrary. "The 'condition' which I call the cause of an event in which I take a practical interest is the condition I am able to produce or prevent at will."¹ It would appear that in this sense of the term, 'cause' is a relative matter depending upon the condition that the interested party is able to produce or prevent.

As we can see the specific nature of the causal relationship can be a complex matter in most instances because of the 'conditions' that are pertinent to any causal situation. It would be simple if the 'cause' and 'effect' could be isolated, so that one could be assured that no other factors are playing any part, but this is usually not possible in practice. This same sort of difficulty is encountered in certain sciences such as biology and psychology when attempts are made to conduct experiments under what are usually described as 'controlled conditions.' Bridgman would seem to be well aware of this problem when he asserts: "The causal concept is not simple by any means. We do not have a simple event A causally connected with a simple event B, but the whole background of the system in which the events occur is included in the concept, and is a vital part of it. If the system, including its past history, were different, the nature of the relation between A and B might change entirely. The causality concept is therefore a relative one, in that it involves the whole system in which the events take place."²

1 - Collingwood, Philosophical Essays, Vol.2, p.302.

2 - P.W. Bridgman, The Logic of Modern Physics, p.83.

Henry Margenau also recognizes the problem¹ and as a result contends that we should distinguish between what he terms 'partial causes' and 'total causes'. Let us consider, for example, a situation where John shoots and kills Harry. John, gun, bullet, and anger are all 'partial' causes. The 'total' cause might be described in this way: Harry is alive, John is angry and holds a loaded gun, etc. The total effect would be: Harry is dead; John holds an empty gun, etc. This view is well taken, and should serve as a warning against taking an oversimplified view of the causation concept.

Still another possibility arises. In some situations involving a number a number of antecedents which could individually produce the effect, one of these may stand out as of special significance. Perhaps the label of 'cause' might be more accurately pinned on such an antecedent. For example, in a specific case of juvenile delinquency, what might be described as multiple causality, is usually applicable, although any one of the factors such as poverty, unstable personality, etc. may be so dominant as readily to suggest that this factor be considered to be the cause. This would, of course, still be using the term in the second sense.

Hobbes also recognizes the importance of necessary conditions, and has an interesting definition of causality. "The cause therefore, of all effects consists in certain accidents both in the agents and in the patients; which, when they are all present, the effect is produced; and that accident either of the agent or patient, without which the effect cannot be produced, is called causa sine qua non.... But a cause simply, ..

1 - The Nature of Physical Reality, p.391.

is the aggregate of all the accidents both of the agents... and of the patient put together;"¹

Considering the cause to be an aggregate of all the indispensable conditions may be a way out of the dilemma of deciding upon which condition to pin the causal label, but probably it would also serve to confuse the issue if the aggregate cause becomes too comprehensive. This fact would also detract from the practical value of the causal idea. If causes are going to be of practical value, it would seem that they should be distinct and readily definable.

There is still another question which offers considerable opportunity for ambiguity and confusion of the term under discussion. Frequently causality is implied when some other term is used. For example, if someone inquires as to the 'reason' or 'explanation' of a car accident, he is obviously thinking of a cause or causes. There would probably be no difficulty involved in the employment of such apparent synonyms as 'reason' and 'explanation' if they invariably had the denotation of 'cause'. In the case of the term 'explanation' the causal implication is not always present, as in the case of my asking someone to 'explain' how an engine works. The term 'reason' would of course not imply causality if employed in mathematics. In the field of natural events the term 'reason' appears to imply the idea of a cause usually, but not invariably. A spark 'causes' a mixture of gasoline and air to explode, but a question as to the 'reason' for the effect would still be in order, over and above the question of the cause. It would seem then

1 - Works of Hobbes, Molesworth, Vol.1, p.399.

that the terms 'reason' and 'explanation', though frequently implying causality, are not to be considered as synonyms for 'cause'.

There is a third sense in which the term 'cause' can be used. "In this case the effect is an event or state of things, and its 'cause' is another event or state of things standing to it in a one - one relation of causal priority."¹ Here natural events are not considered practically as subject to control by human volition, but theoretically as in physics and chemistry.

The chief problem in using the word 'cause' in this manner is to explain what is indicated by asserting that a cause 'produces' its effect. In the first and second uses of the term, there was no particular difficulty.

The rationalist answer to the problem would be that the effect 'necessarily' follows from the cause. A cause, according to this point of view is a 'ground', and its relation to its effect is a logical one of ground to consequent. We already have had occasion to examine this 'implication' theory in Chapter Two. It might be mentioned, however, that such a view of causality could scarcely be a proper basis for the extensive achievements of natural science. These achievements have come about not by finding effects logically implied in causes, but by finding effects from causes through observation and experiment.

Actually in using the term causation in the sense which we are now discussing, probably few would identify it with a logical relation. Likely most would think that causation is something different from logical

1 - Philosophical Essays, Volume 2, p.285.

implication and contains something more than uniformity of conjunction. This 'something more' would be in the nature of compulsion. Such may be the case, though the reply of the empiricist would be that it would be difficult if not impossible to prove, even in those instances where there would appear to be an absolute invariability between two events. The suggestion is strong as we saw in Chapter Two that the notion of compulsion is anthropomorphic. Henry Margenau also accedes to this opinion regarding the notion of compulsion. "The idea of causality has undergone a transformation not unlike that of other scientific concepts, a change which is perhaps best illustrated in the idea of force... The word calls to mind a sort of muscular exertion. This picturesque supplementation of scientific concepts is pleasing because it gives a poetic quality to inanimate dynamic agencies as, for instance, to the water turning a mill wheel or to the engine slowly dragging a freight train up a hill. In these cases it adds a harmless fancy. But it hinders a proper appreciation of such abstract influences as the force of the earth upon the moon... Here the idea must be stripped of its homely suggestions, purged of anthropomorphism, and established on a larger basis."¹

It would appear from the foregoing discussion that this third use of the term 'cause' cannot be proved to detect more than regularity among the phenomena to which it is supposed to apply. Since such regularities can be explained adequately by other laws in which cause does not appear, it would seem that the concept of causality is not very significant in the theoretical sciences. Actually the term 'cause' as it is

normally used should not be applied at all to the relationship now under discussion, as nothing more than regularity would seem to be involved, and certainly this regularity is all that is required for the purposes of the scientist. The case for properly calling such a relationship 'causal' would rest on the proof that something else besides mere regularity was involved. Such a proof would be a philosophical one, and we are not satisfied that it has been provided.

This point that the notion of 'causation is virtually absent from the theoretical sciences will be further confirmed in Chapter Five where we will examine the impact upon the concept of causality of quantum mechanics.

Here is how Stephen Toulmin explains why the causality notion is largely absent in the physical sciences. "In the physical sciences.... the regularities we find... are represented in a way which is application-neutral. Theories which are produced to explain optical phenomena, for instance, do not specifically tell us how to bring about this or that effect.... Problems of application and questions about causes arise with reference to particular contexts, but physical theories are formulated in a manner indifferent to particular contexts: it is when we come to apply theories that we read off from them the causes of this and that, but there is no call for the term 'cause' to figure within the theories themselves."¹

As already indicated in Chapter Two whenever questions are asked about causes, we are concerned with developments which we are interested in producing, preventing, or counteracting. From this we can see why the

term 'cause' is at home in the diagnostic and applied sciences, such as medicine, engineering, and the social sciences, rather than in the physical sciences. This would limit then, the use of the term 'cause' to the first and second senses which we examined earlier in the chapter.

CHAPTER FIVE

CAUSALITY AND THE QUANTUM THEORY

We have seen in what a far-reaching manner Hume challenged the prevailing thought with respect to the concept of causality. An even more significant challenge, however, is provided by a certain aspect of physics, namely quantum mechanics. Hume's scepticism was concerned with the interpretation of the nature of the causation principle. The latest formulations of theoretical physics on the other hand, would seem to cast serious doubt on the validity of the concept as such.

There can scarcely be any question that the Quantum Theory is a revolutionary departure from the old 'classical physics' which depended upon the conception of the atom as being a little hard lump of matter (the 'billiard-ball' view of the atom) which acted according to the inflexible determinism of the laws of mechanics. Now the atom itself is subject to further subdivision into electrons and protons, which are described in terms of electrical charges, and are therefore not 'material' in the sense in which this term has been employed. These new ultimate elements seem to be best described in terms of mathematical symbols.

The basis for the alleged indeterminism of these infinitesimal particles is the fact that we cannot ascertain simultaneously both their velocity and position in space-time, and thus say where they will be a moment from now. This fundamental unpredictability is reflected in Heisenberg's famous Principle of Indeterminacy, which would seem to sub-

stitute statistical law for causal law.

The point to be emphasized is that apparently it is now quite definitely established that the Heisenberg uncertainty relations are fundamental, and are not essentially due to the inherent limitations of the experimental method. "The Heisenberg uncertainty relations are quantum manifestations and must not be confused with the errors of observation that are unavoidable in human measurements; the two types of uncertainty are utterly distinct and have nothing in common..... Thus the possibility of a simultaneous accurate experimental determination of position and momentum is ruled out, not because no experiment has ever been skilful enough to make a measurement of this kind, but because there appears to be a theoretical reason which precludes any such measurement from being performed successfully, even by a superman."¹

We would quite certainly seem to have here a most fundamental divergence of view between the classical tradition of physics and physics today. D'Abro again emphasizes this point: "The quantum disturbances are essential; they owe their existence to the non-vanishing value of Planck's constant h . For this reason even a super-experimenter could not avoid them..... The difference between the classical and the modern stand may be expressed in the statement: Whereas classical science believed that the sequence of successive approximations in our measurements converged to a limit, the uncertainty relations show that there is no such convergence."²

1 - D'Abro, The Decline of Mechanism (In Modern Physics), p.672.

2 - D'Abro, Ibid, p.949.

These rather definite pronouncements would seem to indicate quite emphatically that the principle of rigorous causation is not applicable to quantum mechanics for two very significant reasons. "Thus, not only is a test of rigorous causality excluded for practical reasons, but it is also seen to be impossible in theory - at least in this world of ours."¹

The acceptance of this state of affairs, however, does not necessarily lead us, as some physicists contend, to a rejection of the causal principle in toto. Because this concept apparently does not apply in one area of nature, does not thereby signify that it does not apply in any area. Suppose we grant that the behavior of electrons and protons is not amenable to causal laws; however, when these elements act not as such, but merely as units in another group, is it not possible that the group can behave differently - in this case according to the laws of causality. There would appear to be no incompatibility or mutual exclusiveness between the determinism of macroscopic physics. "We may recall that no inconsistency is involved between the vagueness of the uncertainty relations and the extreme accuracy with which causal relations may be represented in space-time on the macroscopic level."²

There would seem to be scientific evidence to support such a contention. "We conclude that the smaller the mass m of the particle, the more important becomes the uncertainty between position and velocity. Electrons (or still better, photons), owing to their small mass, are among the most favorable kinds of particle on which to detect the in-

1 - A. D'Abro, *The Decline of Mechanism*, p.949.

2 - A. D'Abro, *Ibid*, p.961.

fluence of the uncertainties.... On the other hand, when the mass m becomes larger, the quantum uncertainty decreases and is soon concealed by the practical uncertainties attendant on all human measurements. For this reason the quantum uncertainties must necessarily fail to manifest themselves on the commonplace level, e.g. in the case of billiard balls."¹

The tendency on the part of some modern scientists to discard the principle of causality entirely may be partially explained by the fact that because facts change with the advance of science, so principles associated with the old facts must thereby also be superseded. We should have a better reason. If we are living at a time that is breaking away from the old political and social traditions, this is essentially because the old traditions are not suitable to the changed economic and social order in which we live. But scientific research should be something that is pursued apart from the changing circumstances of human existence.

It apparently was not Heisenberg's intention to attempt an overthrow of the concept of causality. "And the aim which Heisenberg had before his mind in formulating the Principle of Indeterminacy was to find a rule whereby we can deal with minute processes in natural phenomena.... Here the causal principle is not applicable.... But this does not mean that the causal sequence is not actually verified objectively.... The Principle of Indeterminacy is in reality an alternative working hypothesis which takes the place of the strictly causal method

1 - A. D'Abro, The Decline of Mechanism, p.673.

in quantum physics. But Heisenberg himself would be one of the first to protest against the idea of interpreting his Principle of Indeterminacy as tantamount to a denial of the principle of causation."¹

If the principle of causality cannot be applied, can any generalization be made concerning the behavior of the electron? Apparently yes, but only on a statistical basis. "The upshot of the acceptance of the Principle of Uncertainty is the admission that the bases of quantum laws is statistical so that the conception of causal laws ceases to have application."²

It should be remembered, however, that the intrusion of probability coefficients in a theory of mathematical physics does not necessarily connote the absense of underlying causal or other laws. For example, the classical kinetic theory of gases is a statistical theory, and as such is subject to probability considerations. Nevertheless, the theory is based on the assumption that the rigorous laws of mechanics control the motions of the gas molecules.

In the same manner, in considering a group of people we cannot accurately predict how long any individual member of the group will live, because at present we do not have the scientific knowledge to be able to do this. But the life span of this particular individual we might rightly assume, would be determined by prior causes. The mechanist, at least, believes that such an assumption would be completely vindicated if only we had the means of obtaining all the facts. Whatever our views on this point, it would have to be conceded that such in-

1 - Max Planck, Where is Science Going? pp. 32 - 33.

2 - Stebbing, Philosophy and the Physicists, p.182.

formation is at least conceivably knowable.

Under these conditions of incomplete knowledge, we can draw some conclusions on the basis of statistics. Apparently however, even statistics will not help us to make predictions concerning any specific individual in the group. It may be possible with some precision to say that of n people in a group, a will be dead within six years. The probability, in choosing one of the n that will be among the a in six years is $\frac{a}{n}$. The probability that he will not is $1 - \frac{a}{n}$. By substituting some figures, even approximate ones, we can see that the uncertainty of the prediction that he will be among the a is very large, and hence the prediction is not valuable. The uncertainty of the prediction about the a individuals without regard for which a among the n , may be very slight, and hence the prediction is valuable.

It has been the hope of philosophers and some physicists that it is only our lack of complete knowledge which renders it necessary to resort merely to statistical procedure with respect to the behavior of the electron. Such, for example would seem to be the view of P.W. Bridgman. "In general we cannot admit for a minute that a statistical method, unless used to smooth out irrelevant details, can ever mark more than a temporary stage in our progress, because the assumption of events taking place according to pure chance constitutes the complete negation of our fundamental assumption of connectivity; such statistical methods always indicate the presence of physical complications which it must be our aim to disentangle eventually."¹

1 - The Logic of Modern Physics, p.206.

Einstein and Planck have also expressed the opinion that quantum mechanics is incomplete, and that the introduction of new concepts will reinstate rigorous determinism.

Planck expressed his confidence in this belief in the following words: "Why is it then that this hasty conclusion is so much in vogue?... First.... The spirit of the age does want to consider itself free from all laws handed down through the authority of tradition. Secondly, the standardization of modern life with its mass production.... has evolved a system of statistical rules which are true when masses of events are concerned, though they are not applicable to the individual.... Physicists speak of statistical causation as opposed to dynamical causation. But as a matter of fact statistical causality, and even what are called laws of probability are all based on the presupposition of strict causation in the individual cases dealt with."¹

At the present time however, there would appear to be little chance that such a hope is within even remote realization. It would seem that compared with the situation as regards macroscopic phenomena, the situation is entirely different in the quantum theory. It is true that thanks to the more modern methods of quantum mechanics, the probabilities may be calculated theoretically; but even so, their computation is not based on the assumption of deterministic laws governing individual processes.

This distinct emphasis upon statistics in quantum mechanics as well as in other aspects of physics brings us to the role that mathematics plays in this science. It is common knowledge that this role

1 - Where is Science Going? pp. 33 - 34.

is very extensive, but is it all comprehensive? Jeans apparently thought so: "The final truth about a phenomenon resides in the mathematical description of it."¹ According to Jeans, if we apparently cannot explain something mathematically, it is due to our incomplete knowledge, and not that there is anything which is not amenable to mathematical explanation.

It is interesting to notice that there is nothing new about a mathematical epistemology. This was also the point of view of Pythagoras and Plato. That is why the latter had over the door of his academy the words: 'Only mathematicians need enter here'. He was merely saying that no one could master his philosophy without being versed in the fundamental principles of the leading branch of knowledge of the time.

Now it is beyond the scope of this thesis to be concerned with a mathematical theory of epistemology as such, except in so far as it has some bearing on the subject under discussion - causation. Mathematical explanation because it is a different kind of explanation does not necessarily indicate that causation cannot properly be involved. For example the movement of a free falling body can be described by a mathematical formula, but this does not thereby imply that the question, What caused the body to fall? is not a proper question.

To conclude, it would seem to be well established at the present time that the concept of causation is not applicable in quantum mechanics. We can generalize here only on the basis of statistical probability. If this situation is going to be any different, entirely new concepts will

1 - The Mysterious Universe, p.150.

have to be devised. As we have tried to show, all this, however, is not to be construed that the principle of causality has been invalidated per se.

CHAPTER SIX

THE MECHANIST'S VIEW OF CAUSALITY

As regards the nature of causality and how it is to be utilized as an explanatory principle of phenomena, probably the most conspicuous and most profoundly significant division of opinion is that between the schools of materialism and idealism. The idealist believes that the world is essentially a purposive system, and can be best explained in terms of purposes, ends, or ideals, and behind the mere sequence of one event and another there is always a significance or meaning to be discerned. For him the world is vital and teleological.

The materialist denies all this. Since for him everything that exists consists of matter, the one adequate kind of explanation of the world is in terms of mechanical cause and effect. Things happen as they do because they are the necessary sequels of their antecedents. To understand a situation, we must know the situation that preceded it, together with the causal laws according to which the things in that situation behave. A mechanistic explanation is one which explains the nature of a whole as entirely derived from the nature of its parts, unlike idealism which resorts to additional entities such as an entelechy.

To begin with, mechanical causality is implicit more or less in the background of all natural science. Its proponents believe moreover, that eventually even the most unyielding social sciences will also come under its scope, although this is at present a rather distant goal.

While it is probably true that the terms 'materialism' and

'mechanism' are usually closely associated, this is not to maintain that one can be identified with the other. There would seem to be no valid reason why idealism could not be mechanistic. In fact the philosophy of Kant illustrates this very point. For him the fundamental reality was mind, yet the experiences of the mind were governed by the deterministic laws of cause and effect.

Huxley gives confident expression to the mechanistic point of view: "Anyone who is acquainted with the history of science will admit that its progress has in all ages meant, and now more than ever means, the extension of the province of what we call matter and causation and the concomitant gradual banishment from all regions of human thought of what we call spirit and spontaneity."¹ It is agreed that science should proceed on such an assumption; however, as we will endeavor to show, it is very doubtful whether all scientific phenomena can be explained on this basis.

Since the materialist maintains that the world is composed of only one kind of stuff, namely matter, there is no need for a number of different branches of knowledge, each with its own separate set of explanatory principles; only one science will eventually be sufficient to explain everything. This will be the science which studies the elements of things, that is physics. Thus, ultimately the laws of chemistry must be deducible from the laws of physics; the same applies to biology and psychology. Such an explanation of the nature and behavior of complex phenomena by reference exclusively to their constituent parts is called mechanistic, because it is in this matter that we describe the operation

1 - Stebbing, *Philosophy and the Physicists*, p.145.

of a machine, presuming that the parts will not change their nature when they are combined to form the machine.

It would thus be expected, and quite correctly, that such a metaphysic would lay heavy stress upon determinism. Determinism as a scientific principle means that certain kinds of events are so correlated with other events in such a manner that given the former, the latter can be expected to follow. Since all things consist of matter and matter is everywhere the same, there is only one way a given thing can behave in a given set of conditions. The laws of nature do not change; and consequently if we know those laws, and know enough about the matter in question, we can predict the state of affairs with respect to the matter, except in so far as it is affected by matter outside the region.

There is no question that this method of approach is very successful and properly so, as applied to certain sciences, notably physics. It is probable that here no other explanation is required. Even in the other sciences, a vast number of laws of the mechanist type have been discovered, and more are continually being discovered as scientific investigation proceeds. This provides for the confidence of the materialist in believing that everything can be explained in this manner, though at present this cannot be done; not because it can't be, but because our knowledge is still very incomplete in many areas of learning. The idealist would of course deny this. He would insist that some things per se cannot be explained mechanically.

The greatest opposition to the mechanistic theory has been en-

countered first of all in the field of biology. Many thinkers who are quite ready to accept the mechanistic explanation as applied to physics and chemistry, balk at the idea of doing the same in biology. Here in the words of Bertrand Russell is how mechanism applies to biology:

"What distinguishes living from dead matter? Primarily its chemical constitution and cell structure.... There is no reason, except the great complexity of molecules that compose a living body, why such molecules should not be manufactured artificially. The evidence, though not conclusive, tends to show that everything distinctive of living matter can be reduced to chemistry, and therefore ultimately to physics. The fundamental laws governing living matter are, in all likelihood, the very same that govern the behavior of the hydrogen atom, namely the laws of quantum mechanics."¹ It should be noted that Russell himself admits that the evidence for this point of view is 'not conclusive.' This of course does not prove that it will always remain that way, as the idealist would like to believe; although until that time arrives the materialist should not be overly confident since his doctrine is not proved; on the other hand, the idealist's position is that much more plausible because of the incompleteness of the mechanistic evidence.

The mechanist emphatically denies that biology involves any non-physical elements, nor does it require any. "If biology is to be a natural science, we must assume its phenomena to be subject to causal laws in such a way that under determinate observable conditions certain determinate results may be expected. Biologic phenomena can therefore

1 - Human Knowledge, Its Scope and Limits, p.22.

be the objects of science only to the extent that they involve physically verifiable elements. This is not a direct denial of the existence of psychic or non-physical elements in the organism; but it denies that there can be a coherent natural science of biology if these non-physical elements can produce physical effects that thus have no physical causes."¹

To begin with, Cohen would appear to be correct in pointing out that the mechanist cannot disprove the existence of immaterial elements, because they are per se not amenable to the analysis of empirical science; thus they cannot, and the vitalist should note this, either be proved or disproved, though they can be ignored. The point that both mechanist and vitalist should agree on, however, is that biology as an empirical science can deal only with physically verifiable elements subject to causal laws. 'Vital principles', 'entelechies' or 'souls' cannot be studied in the laboratory. The question as to the existence of such entities can properly only be the concern of metaphysics.

The mechanist applies a similar attitude toward the subject of psychology. Here we have this behaviorist position clearly enunciated by a famous psychologist. "I believe that the foundation of all behavior is the reflex arc and that complex modes of reaction to a stimulus are complexes of reflex arcs. I believe that the nervous system is a mechanical system which is sufficient unto itself, and that our final explanation of its activities is to be found in a chemical study of the processes of metabolism that go on within the system."²

1 - Cohen, Reason and Nature, p.247.

2 - Griffith, General Introduction to Psychology, p.122.

Max Planck doesn't go as far in completely reducing psychology to physiology; however, he lays equal emphasis upon determinism underlying the mechanics of behavior. For him, behavior at any moment is a resultant of all the factors of heredity and environment. "The part that force plays in nature, as the cause of motion, has its counterpart in the mental sphere in motive as the cause of conduct. Just as at each and every moment the motion of a material body results necessarily from the combined action of many forces, so human conduct results with the same necessity from the interplay of mutually reinforced or contradicting motives, which partly in the conscious and partially also in the unconscious sphere work their way forward towards the result."¹ This means that the postulate of complete determinism is accepted as a necessary condition for the progress of psychological research.

It would appear that psychology, as biology must postulate complete determinism, if it is to make valid claim to be a science. Capricious action does not seem to be amenable to scientific investigation except possibly on the basis of statistical description. This is of course no proof for psychological determinism. Nature is not always constructed for the convenience of the scientist. There is no a priori logical necessity why determinism must apply to behavior, even though it would seem to apply in other spheres of study. There would appear to be little doubt that a large part of behavior can be explained in terms of the conditioned reflex. There is, however, still the question whether all behavior can be explained in this way. "Until more is known about

¹ = Where is Science Going? p.153.

the brain, than is known at present, it will not be possible to answer this question confidently in either sense. But there are already some grounds, though not conclusive ones for regarding what might be called the materialist answer as the more probable one.... Conditioned reflexes suffice to explain a great part of human behavior; whether there is a residue that cannot be so explained must remain, for the present, an open question."¹

We can be reasonably certain then, that for the present the doctrine of a complete psychological determinism is not proved. There is scarcely any question that the materialist philosophy is in undisputed possession of the realm of inorganic matter. This is not the case however, with the realms of life and of mind. The mechanist is confident that further research will fully vindicate his point of view. He may be right. It would seem that time alone will provide a decisive answer.

The correlation as required by determinism between events is complete in some of the physical sciences, such as macroscopic physics. In other sciences, however, even in some fields of physical science, the correlation between events is not complete, so that we have only partial determinism, the degree of which varies from one field of study to another. Even those who hold a theoretical belief in complete determinism must admit that in many fields of study there is in practice only partial determinism, that is, there is not a 100 per cent correlation between cause and effect. This would be the case in the fields of medicine, psychology, biology, and the social sciences generally. It is true that if we are to investigate these subjects in a scientific manner, we must assume that

1 - Russell, Human Knowledge - Its Scope and Limits, p.54.

their manifestations are deterministic; this is no assurance however, that we will ever be able to trace this determinism completely in these subjects.

It is obvious therefore, that partial indeterminism at least, is not incompatible with any current scientific facts or principles. The indeterminism of quantum mechanics, already discussed, provides further evidence.

Empirically it seems plain that the great majority of our volitions are completely determined by antecedent factors. In these instances, science can analyze more or less exhaustively the prior causes and attendant conditions which adequately explain the resultant behavior. Psychology has sufficient evidence of this type at present to constitute a formidable case for a purely deterministic basis of behavior, and this evidence is increasing with the continued progress in this science. Since it is only a comparatively short time since Wundt established psychology as a science in the genuine sense of the term, and keeping in mind the significant advances already achieved, the determinist can be justifiably confident that his position will eventually be completely vindicated. This however, is not proof necessarily that all volitions fall into this category. Russell, among many others, believes that they all do. "There are, however, precisely the same kinds of reasons for regarding it as probable that they all have causes as there are in the case of physical events."¹ Even though it is true that psychological determinism is not completely established in actual practice, still it can scarcely be

1 - Our Knowledge of the External World, p.232.

reasonably denied that there is sufficient evidence already available to make it difficult to refute the mechanist successfully.

We must, however, recognize that the human organism is highly complex, and most certainly does not lend itself to the precise type of experimentation we have in physics because of too many uncontrollable variables. Thus psychological determinism as yet is not a decisively proven fact, though eventually it will probably so become. It is very difficult to refute not only because of its initial plausibility in that it is an empirical fact that most volitions are the result of antecedent factors, but also because if one objects that overt behavior cannot always be accurately predicted, thus indicating indeterminism, the determinist replies that this is due to the fact that our knowledge of the contributing factors is incomplete. The assumption is that if we had perfect knowledge of an individual, and had a perfect appraisal of the effect of circumstances, then we could make accurate predictions.

This behavior might be completely deterministic in the sense that it would exclude the possibility of caprice, but since we are dealing with so many variable factors which perform interdependently, rather than separately, it is impossible to demonstrate specifically the operation of the determinism, though we are convinced it is there.

By the very nature of things this will probably always be the case in psychology, biology, and the social sciences, though to a progressively decreasing extent. The determinist must realize that his principle can be conclusively demonstrated only when discrete elements are concerned, and when contributing factors can be isolated and con-

trolled. The three fields just mentioned by their very nature are not fully amenable to this type of investigation. If we take our analysis too far in psychology and biology, we no longer have a mind or organism respectively, and what we learn about the elements does not apply to the whole. In these cases we can but vaguely discern the applicability of determinism. Here we may postulate complete determinism, for the sake of theoretical universality, but in actual practice we must resign ourselves to the fact that in some instances we may never be able to trace its operation in precise detail. A realistic approach should not let this admission discourage us from pursuing our researches into these fields of study. Though in any individual case, we cannot determine why a person commits a crime, we can still make significant progress by analyzing more and more cases, and thus make a progressively more accurate statistical correlation between cause and effect.

If there would seem to be any misgivings concerning the applicability of determinism to normal behavior, then one would anticipate that such misgivings would be increased as regards the field of mental aberration. The determinist, however, acts on the same assumption here, as he did in regards to normal psychology, and as before, he needs to make such an assumption, if he is to claim that abnormal psychology is a valid science. ".... every insane utterance, every morbid perception has a definite meaning and a definite raison d'etre when analyzed. Truly there is method in madness."¹ Referring to symbolic acts, Brill continues in the same vein. "These examples show that there is nothing arbitrary or for-

tuitous in our actions. No matter how trivial or voluntary, analysis always shows that this action is fully determined."¹

The case for determinism in abnormal psychology is probably reinforced by the recognition of the fact that determining factors may be buried deep in the unconscious. If these factors are not known to the individual because they exist in the unconscious, they are not subject to volitional control, and their influence upon the individual could operate on a strictly causal basis as it seems to, though again, there is no logical necessity why this should be so. We shall have occasion to refer to the concept of the unconscious more fully in the next chapter.

The belief that mechanical causes alone are fundamental has been with us from the very dawn of the history of philosophy. In the sixth century B.C. Thales of Miletus propounded the daring doctrine that 'everything is water.' Thales chose water presumably because of its remarkable variability of form. Though it is normally liquid, high temperatures will vaporize it, low temperatures will solidify it, in each case altering a great many of its properties; yet it is the same stuff which undergoes these transformations. Here we have the fundamental monism of materialism that throughout all the modifications of form and structure which physical objects are subject to, there is a persistent, underlying stuff, which, while subject to these changes, is nevertheless the same stuff all the time.

The most comprehensive materialist theory of ancient times, however, was formulated by the atomists Democritus and Leucippus.

1 - Brill, Psychoanalysis, p.240.

According to them, everything in the world consists of small pieces of matter called 'atoms' or 'indivisibles' which are too minute to be perceived by the senses. These atoms are all alike but they differ in size and shape, and in different things they are in different positions, moving at different velocities and in different directions. These variations of the arrangement in space of one identical matter provide all the variety there is in the world. Even though it was common in antiquity to reproach the atomists with attributing everything to chance, they were on the contrary, strict determinists who believed that everything happens in accordance with natural laws. They were perhaps, not too concerned with the origin of the cosmos, but when once the world existed, its subsequent development was unalterably fixed by mechanical principles.

Democritus's emancipation from the old Greek mythology, his thoroughly naturalistic spirit, his appreciation of physical, determined causal relationship - these could have been valuable for subsequent scientific progress but, vigorous as the movement was, it was obscured and overshadowed by the Aristotelean teleological interpretation of nature which, despite the valid intentions of its author, and its positive aspects, paralyzed the advance of genuine scientific effort for almost two thousand years.

The middle ages witnessed a concerted attempt to dominate physical science, and all other fields of study with a priori teleological conceptions grounded in an orthodox theology. Only final causes were regarded as capable of providing a satisfactory explanation of

natural events. Actually, insofar as this was achieved there was no legitimate science. Occasionally there was heard a dissenting voice such as that of Bacon in the thirteenth century. He expressed a necessity for experimentally verifying the conclusions reached by a priori argument. He was however, far in advance of his time, and several centuries passed before his ideas bore fruit.

The period between 1450 and 1650 saw the gradual destruction of the unrealistic medieval outlook on nature, and the gradual evolution of the spirit of modern science. It was the reaction, in the re-awakening of the dormant spirit of scientific inquiry to the Renaissance that the all-comprehensive mantle of teleology and its maintainer in power - orthodox theological authoritarianism was cast aside and genuine science as a distinct and independent branch of learning reared its infant head. The formulation of scientific hypotheses, theories, and laws based on determined causal principles, and propounded subsequent to careful observation and experimentation began to replace theological and philosophical nomenclature of explanation, and empirical science began to make rapid progress, though it was still some time before it completely disassociated itself from its former affiliations.

Galileo was probably the first to appreciate fully the significance of the change in outlook. "To Galileo belongs the merit of refusing to find in final causes or in a Supreme Cause the answer to those questions which men desire to put concerning what happens in nature."¹ Galileo's difficulties with the Inquisition adequately illust-

1 - Stebbing, Philosophy and the Physicists, p.157.

rate the prevailing opinion of orthodox theology regarding his scientific endeavors and also provides the reason why the middle ages were so barren of real scientific achievement.

To Galileo, nature presents herself as a single, orderly system whose every proceeding is thoroughly regular and inexorably necessary. With him the physical world begins to be conceived as a perfect machine whose future activities can be completely predicted and controlled by one who has full knowledge of the present motions.

Galileo's discoveries were thoroughly studied by Descartes who inferred from them that the universe was to be explained by the application of law. The teleological explanation he considers erroneous: "I am convinced that the whole class of final causes can have no place in the explanation of nature, for it seems to be to be temerity to inquire into the purpose of God."¹ He, like Bacon declared final causes to be unknowable.

Descartes, however did not include the mind in his mechanistic explanation. Mental life was for him essentially active, voluntary, and independent of matter. His absolutely discrete dualism necessitated the postulation of parallelism in an attempt to explain the relation between the two separate elements of body and mind.

For whatever reasons they had, Descartes, and others of his time and later, despite their materialist inclinations, couldn't seem to bring themselves to include all of the external world and the whole human organism under a mechanical scheme of things. In the words of

1 - Meditations, p.4.

Sellar: "It is pretty generally admitted now that Cartesian parallelism reflected the scientific situation of the time. The physical world was conceived as a huge machine operating according to the laws of mathematics.... the individuals actions were, like all other motions, effects of specific conditions interpretable by the laws of mechanics.... but the soul was distinct and separate. The result was that science compromised with supernaturalism by means of a division of reality. Consciousness and the soul were voluntarily extruded from the physical realm."¹

With Galileo and Descartes the world is pictured concretely as material rather than spiritual, as mechanical rather than teleological. This tendency continued and expanded and throughout the seventeenth and eighteenth centuries science was steadily unfolding to the world the picture of a universe ruled by unvarying laws, in which there was left progressively less room for supernatural intervention. Thus: "It is true that by Newton and Boyle the material world-machine was again provided with a spiritual constructor, but the mechanical and materialistic theory of nature only rooted itself the more firmly the more one could pacify religion by appealing to the Divine inventor of the great machine."²

Boyle expresses his view in the following: "Nature does play the mechanician; mathematical and mechanical principles are the alphabet in which God wrote the world."³ Boyle was deeply religious, and

1 - Evolutionary Naturalism, p.289.

2 - Lange, History of Materialism, Vol.2, p.3.

3 - E.A. Burtt, The Metaphysical Foundations of Modern Science, p.138.

having established God, he was content to interpret His place in the world and relation to man in accepted Christian fashion.

In the case of Newton, though God has an important role to play in the metaphysical background of his Natural Philosophy, He does not enter into his calculations. Newton was a thorough going empiricist. He made vigorous assertions as to the superiority of the experimental over the deductive method, the latter based upon a priori assumptions. "For Newton then, science was composed of laws stating the mathematical behavior of nature solely - laws clearly deducible from phenomena and exactly verifiable in phenomena - everything further is to be swept out of science, which thus becomes a body of absolutely certain truth about the doings of the physical world."¹

The advent of the nineteenth century then saw the principle of mechanical causality definitely established in natural science, though there was still hesitation to apply the doctrine universally. The work of Descartes, Kepler, Galileo, and Newton laid foundations of a scheme of deterministic law that for nearly three centuries has been unhesitatingly accepted by the physical scientists. Developments in physics were consistent with and indeed dependent upon the assumption that the movements of matter took place in accordance with certain ascertainable laws.

The nineteenth century saw the final plunge made, and mechanism extended to include psychology and biology. T.H. Huxley is primarily associated with this development. He was the great popularizer of

1 - E.A.Burt, The Metaphysical Foundations of Modern Science, p.223.

Darwinism, and a stout believer in the possibility of extending the 'reign of law' from mechanical and chemical phenomena to the phenomena of biological development, and thence to the mental life of human beings. In his address delivered at Edinburgh on Nov. 8, 1868, he said: "All vital action may be said to be the result of the molecular forces of the protoplasm which displays it... the thoughts to which I am now giving utterance and your thoughts regarding them are the expression of molecular changes in that matter of life which is the source of our other vital phenomena."¹

Human actions according to Huxley are thus instances of natural laws, and human beings 'conscious automata.' Human beings belong to nature, and nature is an unbroken continuity of material causes.

This was the period when the industrial revolution was at its height and only little reflection was necessary to impress one with the great influence wielded by the machine in the lives of people. As could be expected however, a reaction was bound to materialize. Natural science with its own unique principle of causality had attained unprecedented success, and, flushed with this unparalleled good fortune, had in some quarters become arrogant. The reaction came with the advent of the twentieth century, and was spearheaded by the science of physics. This section of our enquiry we have had to occasion to carry on elsewhere.

The mechanist of course realizes that though he assumes determinism to underlie all aspects of nature, many situations are so complex that it is difficult to prove the cause and effect relationship. It is

1 - Stebbing, Philosophy and the Physicists, p.145.

probably correct, for example, that tuberculosis is caused by a certain kind of bacillus, but it would also seem to be true that unless the conditions of body resistance, etc. are favorable, the effect does not materialize. A conflict will produce neurosis or even psychosis in certain cases and not in others; presumably certain circumstances must be present before the cause can produce the effect. As a matter of fact both of these examples would seem to indicate that in some instances at least, the study of concomitant conditions might be just as important as the study of causes.

It would appear we should guard against interpreting the relation between cause and effect in a manner that is too simple and direct. This should not discourage us from endeavoring to isolate specific and distinct causes and effects, but they should not be violently extracted out of context.

This also applies with equal validity to the teleological interpretation of cause and effect with the corresponding terms of means and ends. It is common knowledge how obstacles can prevent the attainment of final causes, or can necessitate the modification of means in order to achieve the same end.

In certain other instances, effects are not the result of single causes, but rather the result of a number of distinctly definable elements acting interdependently within the whole situation. Further variability is provided by the fact that the individual causal factors may perform with greater or less intensity in different specific situations. Thus, in psychopathology, Billings is probably cor-

rect when he attests to the applicability of multiple causality: "Here it must be remembered that practically never is one situation or one factor the whole cause of the illness. There are always multiple factors existent in the patient's personality, in his past experiences, and in his present environment."¹

A similar situation prevails in the field of delinquency and crime according to the investigations of Reckless and Smith.² It used to be believed that a single cause in the form of an innate tendency produced transgressions of the law. It is obvious now that we must now look to a combination of individual and social factors. Poverty or an extremely unfavorable environment do not as such necessarily lead to crime without due regard to the role of other pertinent conditions and causes.

In this connection Gilbert Ryle in *The Concept of Mind* develops a significant distinction between those causal factors that are events, and those that are dispositions. Let us consider the example of a stone causing a glass to shatter. Undoubtedly the usual opinion on the matter would be that the stone 'caused' the glass to shatter, and this causal factor would be properly considered as an 'event.' Ryle contends, and with considerable justification, that frequently the disposition is just as important as a causal factor. Thus in our example, the shattering would not take place if the disposition of the material was different - wood instead of glass. This observation would seem to indicate that in some

1 - A Handbook of Elementary Psychobiology and Psychiatry, p.119.

2 - Juvenile Delinquency.

instances though the cause, as an event, is the same, the effect may be different because conditions are different. In this connection it might also be pointed out that the same effect can be produced by different causes under different circumstances. Wars, for example, would not in every case have the same antecedents.

In view of the foregoing discussion, it would seem that whether we are mechanists or teleologists, we should recognize that the operations of cause and effect is not a simple matter, and that we are still a very long way from the ideal of being able to demonstrate precisely the workings of determinism in all specific instances. The materialist may be right, but his case is far from being conclusively proved.

CHAPTER SEVEN

THE CONCEPT OF TELEOLOGICAL CAUSALITY

Teleological causality involves the concept of purpose or design with the requisite arrangement of means for the attainment of the end. Thus, whenever is discovered a plurality of elements, which are independent of each other, so arranged that their association regularly produces a rational or valuable result, it is assumed that the arrangement of the constituent parts has been produced by an intelligence which desires the result as an end, and employs the parts as means to this end.

Teleology is based chiefly upon the argument from design as it is called, which declares that nature as a whole illustrates this type of causality. We have not witnessed the initial arrangement of the parts, but everywhere we meet products of nature which so closely resemble products of human art and design, that we are almost compelled to conclude that here is definite arrangement of means for the attainment of an appropriate end.

There would appear to be two distinct types of teleology. The first would apply to the purposive actions of a conscious being. Here there is more or less deliberate choice of means designed to attain the desired goal or objective. Because the being concerned is conscious, it is in a position to make fitting adjustments in the means if circumstances so warrant.

The other type might be termed 'immanent' teleology. For ex-

ample, the acorn has the principle of its development into an oak tree within itself. There is no question here of a conscious adaptation of means to ends. It might be worth noting that in this case, the organism is not as capable as the conscious being of making appropriate adjustments to adverse conditions that interfere or hinder the attainment of the end.

Teleology maintains that certain phenomena of nature, especially the organic formations, cannot be explained in purely physical terms. Their similarity to human art and design is so great that they can be explained only as a system of means and ends, which owes its arrangement to an intelligent being. And therefore, since these formations are inseparably connected with nature as a whole, the entire scheme must be regarded as the product of intelligence.

The teleogist contends that the world must be the handiwork of an Intelligence, because he notes so much that is rational in it. This would appear to be based on the notion that cause and effect must be qualitatively alike. This may apply in some cases, and might even be a reasonably valid reason for discrediting of a cause and effect relationship in a specific case. The collapse of a building for example could not be attributed to a boy throwing stones at it. The principle, however, is not universally true. A draught is not much like a cold in the head. The world is intelligible because it is constituted of elements which behave in uniform ways, and thus make it possible for us to generalize concerning them. This, per se does not denote intelligent planning, though the suggestion is so distinct as to be practically irresistible

and justifiably so.

The evidence would seem to be so strong, that one would wonder what possible rebuttal the mechanist could muster; yet he can and a two-fold one at that.

In the first place, the design, however wonderful compared to human ingenuity and constructive capacity, is in many respects manifestly imperfect. The perfectly healthy body for example is a phenomenon unknown in nature. In frequent instances, the purposes which we can detect in the organization of organic matter are not completely executed. In the human sphere, because of the discrepancy between goal and capacity, life is replete with frustration, pain, and defeat.

Even in the face of the above rather common knowledge, however, the case for a teleological viewpoint remains formidable, although it should be admitted that the evidence is not decisive on either side.

Historically, the teleological doctrine was comprehensively enunciated in antiquity by Plato and Aristotle. Plato thoroughly believed in a universe governed by law, but the mechanical laws of the natural philosophers could not, he was convinced, explain the higher aspects of the life of man and also of the Universe, in which, following Socrates, his interests were most deeply centered. The teleological cosmology of Plato consisted in his regarding Being or the world of Ideas as both purpose and cause of phenomena or the world of matter, and besides these teleological causes, he recognized no others in the strict sense of the term. "And in the divine nature of Zeus would you not say that there is the soul and mind of a king, because there is in him the power of the cause."¹

1 - Philebus, pp.28 - 30.

Aristotle's views on causality were much more explicit than those of Plato, because unlike the former, the latter carried on his discussions in the medium of dialectic, poetic imagery, and myth. For Aristotle, causes are the real explanations of things, because they not only inform us that certain things exist, but why they exist. He discerned four causes: Thus the material cause of a house is the lumber, etc. used in its construction. The formal cause is the plan which is primarily mathematical; the efficient cause is the workmen who construct the house, and the final cause is the purpose the house serves in providing shelter. "Further the final cause is an end and that sort of end, not for the sake of something else, but for whose sake everything else is."¹

When we remember Aristotle's preoccupation with biological studies, we may more easily appreciate this influence on his views on causality. The true cause of the development of any organism is the entelechy which means the final end or completed form. We are now in a position to see how the concept of final cause dominated Aristotle's notions of causality. The biological conception of causality attributes to each individual thing the character of an organism, self-contained and self-developing from within.

The final cause does not of course, preclude the possibility of other causes which belong to a thing only incidentally. Every fact or event, however accidental it may appear, has a causal explanation, but science as such is only interested in those causes which pertain to

1 - *Metaphysica*, 994b, 5. Works of Aristotle, Vol.8, Translated by J.A. Smith & W.D. Ross.

-the essence of a thing, causes that are not incidental but necessary.

Without delving into a detailed appraisal of Aristotle's ideas, it is clear that he greatly overestimated the importance of teleology. Certainly this would be true in the light of the subsequent progress of empirical science on the basis of mechanical laws of causality.

Aristotle's emphasis upon final causes held undisputed sway until the modern period of science to which we have already had occasion to refer. When the reaction did come the emphasis was now applied to efficient causes, culminating in the predominance of mechanism in the nineteenth century. In the twentieth century we are witnessing in turn a reaction against mechanism. Because empirical science is so thoroughly established, this reaction is not likely to proceed to the extent of Aristotelean teleology prevailing during the middle ages.

Thus we have Eddington, one of the leading exponents of this reaction, inferring a teleological scheme of things from the present state of physics: "The idea of a universal Mind or Logos would I think be a fairly plausible inference from the present state of scientific theory, at least it is in harmony with it."¹ Just how he deduces such a conclusion from the basis of scientific theory is not clear, and whether he is justified is extremely debatable.

It would appear that Eddington's position stems from the seemingly 'immaterial and indeterministic' nature of the electron. In this instance, Eddington and others who have committed the same error,

1 - The Nature of the Physical World, p.338.

would appear to be confusing the issue in assuming that because a relation is indeterministic it must therefore be teleological. As a matter of fact, the problem of determinism arises for the teleologist as well as for the mechanist. Even if it can be demonstrated, that the ultimate constituents of matter are indeterministic (and the Quantum Theory would seem to have done this) this certainly does not demonstrate that their behavior is purposive - the likelihood rather is quite to the contrary. Mechanical explanations do not cease to be mechanical (that is void of life and purpose) because they are shown to have an indeterministic basis. In the same way teleological causes may be just as deterministic as mechanical ones. They were just that for St. Augustine and Calvin.

Actually there is good reason to contend that most, perhaps all, teleological causes are subject to deterministic laws, especially where it is a case of immanent teleology. There would seem to be good reason to believe that in our example concerning the acorn, the development of the acorn into the oak would be in accordance with unvarying, fixed laws. In the last chapter we saw that there is considerable evidence now available to justify our assuming that determinism underlies even overt human behavior. If this is the case, the first type of teleology we defined requiring the arrangement of means in view of ends by a conscious being, would also be governed by deterministic laws.

The mechanist contends that the assumption of a spiritual or non-physical cause operating teleologically is unnecessary because for all such phenomena, at present so explained, a mechanical cause can be discovered. This has already been accomplished in many cases, and more

and more instances will lend themselves to this type of explanation as time goes on, until eventually all phenomena are covered. It is obvious that only time will reveal whether this anticipation materializes. There is also the question if a mechanical explanation is available, a further teleological aspect is rendered superfluous thereby. We might know all the cause and effects which sustain life, yet why should that preclude the merit in considering the purpose served by that life?

It is true that teleology cannot be 'scientifically' proved. "Neither natural nor historical teleology has the value of a scientific theory."¹ Neither, by the same token, however, can it be disproved. If, per se, it is supraphysical, it cannot be properly investigated by the methods of physical science.

Moreover, suppose that we assume that a purpose is known to exist apart from its physical expression. Can it possibly explain how a physical occurrence comes to pass unless we also know of some mechanism used for the purpose? For example, "Even in human beings we do not regard the mere psychic element of fear as the adequate cause of running away. Apart from the James-Lange theory of emotions.... it seems fairly well established that an adequate explanation of the running must involve a physical mechanism. The vitalist may maintain the debatable position that the psychic element is independent and necessary to set the mechanism in motion. He has, however, no evidence for the view that the kinetic energy of the organic motion has no physical cause but is created ad hoc by the mental element. Such a view is indistinguishable from a

1 - Lange, History of Materialism, Vol.2, p.179.

belief in magic. It is not coherent with biologic science."¹ Surely, the teleologist cannot contend that purpose renders physical explanation unimportant or superfluous. Surely few confusions in the history of human thought have as serious and widespread implications as the notion that teleology to the exclusion of mechanism can provide a complete explanation.

The mechanism - teleology controversy is probably most contentious as regards biology and psychology.

In biology the issue revolves around the essential difference between organic and inorganic matter. The teleologist insists that the differentiating element is non-physical and thus cannot be explained in terms of mechanical cause and effect. Confirmation of this point of view would seem to be provided by the fact that biology does not lend itself to the experimental method in the same manner as physics and chemistry, because of the difficulty in holding variable factors constant. The mechanist recognizes the difficulty, but is confident that it will be overcome progressively as our knowledge in research method advances. Again only time will tell whether biology can be completely explained in mechanistic terms; at present there is no basis of making a definite decision either way. The mechanist should however realize that there is no logical necessity for mechanism in biology, even though it may be completely established in other spheres, for while the determinism of physical science is an irrefutable postulate necessary for the undertaking of experimental tests, it is after all only an ideal and

1 - M.R. Cohen, Reason and Nature, pp. 264,265.

there is no logically conclusive reason that this ideal is always attainable.

As things are, there is no doubt that we observe a much higher degree of variability in biology than in physics. This is probably significant, but not conclusive evidence for the vitalist.

The issue of the fundamental difference between organic and inorganic matter, the mechanist and the vitalist, would be settled if biochemistry could construct a cell. There would then be no need of positing non-physical factors. This seems remote at present, though there is certainly no reason to believe that it is impossible. It should be noted, however, that this would not resolve the question as to the primacy of mechanical or teleological causes, though the natural tendency would be to interpret such a development in favor of materialism.

The relation of means and ends coincides with that of cause and effect to the extent that both means and causes are antecedents which precede ends and effects as temporal consequences. In the teleological relation the value of the antecedent is subordinated to that of the consequent, while in the causal relation the antecedent is viewed as determining the nature of the consequent. Nevertheless, "where no causal relation can be established.... we have no warrant for speaking of the adaptation of means to ends."¹ Teleology then constitutes a particularly dynamic relation between antecedent and consequent in which the former aims at the latter as a goal. We should certainly recognize this significant difference, although the teleologist is unjustified if he con-

1 - M.R. Cohen, Reason and Nature, p.264.

tends that the relation of means and ends cannot be deterministic, although it may not be.

If the vitalist is sure of his ground in most phases of his controversy with the materialist, he is probably most confident as regards the phenomenon of consciousness. Here, he maintains, is something which cannot possibly be explained in materialistic terms exclusively. "It may well be urged that since mental events undoubtedly do take place in the natural world, they must have some natural cause or some sufficient reason to determine why consciousness takes place when it does rather than not. But not only is such reason yet unknown, but if we found it, it would have to be quite different from the causal relation that binds together physical changes according to the laws of mechanics, thermodynamics or electricity, since consciousness is qualitatively different from what these laws govern."¹

It would appear that the idea of consciousness is such a direct, forceful, and elementary experience that it could scarcely be reasonably denied. Yet the behaviorist does exactly that, because he contends that consciousness is the result of introspection which is completely unreliable as a source of knowledge. It is true that introspection by its very nature is susceptible to error; it is in constant need of refinement; but to deny that it can play any role is surely unrealistic. There seems to be little reason to suppose that a science of human conduct can be developed without some reference to properly controlled introspection. A doctor, for example requires the

1 - M.R. Cohen, Reason and Nature, p.264.

introspective observations of his patient to assist him in making a proper diagnosis. All other methods of obtaining knowledge are also susceptible to error, even though this may apply to a greater extent to introspection because of the greater element of subjectivism.

One reason for the importance of consciousness to the vitalist is its close association with teleology. He should realize, however, that while humans are undoubtedly frequently conscious of what they are doing, and while some animals may be so, there is no reason to suppose that conscious prevision is concomitant to every act which can be interpreted as a means for the attainment of an end.

In the human field there would now seem to be considerable evidence to demonstrate that even purposive behavior can have its antecedents buried in the unconscious, as elaborated by Von Hartmann (Philosophy of the Unconscious) and more recently by Sigmund Freud, whose psychoanalytic school has pioneered the investigation into the concept of the unconscious, though there is now considerable corroboration from other psychological sources. Thus Cameron, who is strongly oriented in favor of the experimental method makes this significant statement: "There is already an abundance of material to show that consciousness does not report all the changes which occur at the level of mentation... or that it makes its report in a direct form."¹ He goes on to pay tribute to Freud concerning the matter: "The Freudian school constitutes one of the most extensive bodies of evidence that important aspects of the organism may not reach the level of consciousness at all."²

1 - Objective and Experimental Psychiatry, p.10.

2 - Ibid, p.10.

Strecher, Ebaugh, and Ewalt, prominent American psychiatrists, are just as definite in their statement concerning this matter.¹ In view of such compelling evidence, the matter of the existence of the unconscious can hardly be a matter of reasonable doubt. The evidence shows also that behavior resulting from these unconscious antecedents can be interpreted no less teleologically.

In most other cases, the purposive behavior can probably be quite simply explained by the fact that the organism is unconsciously behaving in accordance with teleological laws immanent in its own nature. "So we come to assign teleological activity to organic life in general, not in the sense that the organism is jointed together by a thinking being external to it but because it is the manifestation of an inner life unfolding itself with inner necessity."² This would appear to point to the fact that teleology and determinism are not mutually exclusive. On this view, it would not be necessary to assume some psychic or occult forces operating in plants and animals which enable the latter to make appropriate adjustments to their environment, and often very complicated and marvelous adjustments at that.

The materialist argument against consciousness is inadequate. This is even confessed by those who in other respects support its doctrines, such as C.H. Whiteley. "If then we are to take this doctrine quite seriously, we must suppose that I am subject to an incessant illusion of actually doing things.... we feel that we can decide, and

1 - Practical Clinical Psychiatry, Sixth Edition, p.404.

2 - Lange, Ibid, p.228.

that our deciding makes a difference; but ~~for~~ that feeling the materialist philosophy can provide neither justification nor explanation.... The rejection of such elementary features (consciousness) in our experience of living seems to me to demand pretty strong proof before we can submit to it. Such a strong proof we cannot obtain.... There is after all, a great difference between the behavior of a conscious and of an unconscious man; and the plausible assumption.... is that consciousness makes a difference."¹

Our discussion of mechanism and teleology would appear to lead us to the conclusion that the acceptance of a teleological explanation of a process does not rule out an investigation into its mechanical explanation. The two kinds of explanation are not mutually exclusive; they are complementary. The idealist philosophers were mistaken in alleging a conflict. There is no opposition whatever between the mechanical explanation and the idealistic interpretation as such. The conflict arises only when the idealistic interpretation strives to take the place of the causal explanation and to render it superfluous.

Over-emphasis of either will provide us with a distorted and unrealistic conception of nature. Neither one will ever give us the complete answer.

It is the realization of this fact that has prompted numerous thinkers to formulate points of view which would fall more or less midway between the extremes of mechanism and teleology. It is beyond the scope of this thesis to consider any of these even in a cursory fashion. Thus

1 - An Introduction to Metaphysics, pp. 58 - 59.

we have the doctrine of evolution most comprehensively enunciated by Darwin. We have had occasion to make reference already to the 'creative evolution' of Henri Bergson. John Dewey called his theory instrumentalism and it has seen its greatest application in the field of education. We have also the psychological school of Gestalt with its emphasis upon the total situation. Whitehead is probably right in contending that "one task of a sound metaphysics is to exhibit final and efficient causes in their proper relation to each other."¹ He calls his scheme 'organic philosophy.' C.D. Broad labels his system 'emergent vitalism' and succeeds quite convincingly² to overcome the defects of materialism without resorting to non-physical entities.

1 - Process and Reality, p.92.

2 - Mind and Its Place in Nature.

CHAPTER EIGHT

CONCLUSION

The concept of causality has always been, and continues to be a very essential principle in the epistemology of philosophy and the applied sciences. As in the case of so many other problems of philosophy and science, considerable divergence of opinion has from the beginning always been in evidence with respect to the nature of the causal principle. The very dawn of philosophic thinking witnessed the opposition between the mechanism of Democritus and the fundamental teleology of Plato and Aristotle.

According to the 'regularity view' causation involves nothing more than temporal sequence. According to the 'necessitarian view' the 'extra something' is the idea of compulsion; the effect 'must' follow from the cause. This is difficult to prove, and some writers such as Collingwood maintain that the notion of compulsion is anthropomorphic. In any case the establishment of regularity in events is sufficient for the theoretical sciences, so that here the notion of causation is virtually absent.

Hume correctly demonstrated that idea of 'necessity' or 'compulsion' in the causal relationship cannot be derived from experience. It cannot be proved logically because the denial of necessity does not involve us in logical contradiction in the way that the idea of a square circle would. For various reasons Kant did not succeed in

demonstrating that causation is a category belonging to the intrinsic constitution of the mind. It would seem that 'necessity' also cannot be deduced or inferred from the observation of connection in numerous specific cases.

What then is the characteristic nature of the causal connection. There would seem to be two senses in which the term 'cause' can be properly used, neither one requiring the inclusion of the 'necessity' idea. The first sense refers to effects brought about by a conscious and responsible agent. It should be noted that 'cause' and 'motive' however, do not always coincide. To discover the cause of an event in the second sense means to find out what needs to be altered if we are to produce, prevent, or counteract it. This is the sense in which the term is used in the applied sciences. The notion of cause is hardly applicable to the theoretical sciences, such as physics and chemistry because relations between objects or events here can be adequately explained on the basis of laws in which cause does not appear.

A more significant challenge to the validity of causality than that provided by Hume, is to be encountered in the formulations of modern physics. It is alleged by some that the advent of quantum mechanics and what Eddington describes as the Principle of Indeterminacy has overthrown the principle of causality. This conclusion is probably unwarranted, though the discovery that the electron is undetermined is a very significant revelation, as it signifies that nature is not universally subject to the laws of cause and effect. The fact that

this is true of microscopic physics does not thereby prove however, that no aspect of nature can now be described in terms of cause and effect. Actually there is no reason to believe that in the case of macroscopic manifestations, causality is less relevant now than before the advent of the quantum theory.

If the ultimate constituents of matter are undetermined, then any generalizations with respect to their behavior must be made on the basis of statistical probability. The question arises whether this indeterminism of the electron is fundamental, or does the physicist resort to statistics because he doesn't know enough about the individual element to make exact predictions, though he assumes that the elements are governed by underlying causal laws. Apparently quantum physics considers these statistical laws to be fundamental and some physicists contend that the causal laws of macroscopic phenomena are also basically statistical.

It may be true that statistical laws are fundamental to the ultimate constituents of matter. This certainly does not indicate that in every other case the proper application of statistical generalization precludes the valid assumption of laws of cause and effect. We use statistics to systematize our information on crime and delinquency, yet we assume, and properly, that these manifestations are subject to causal laws, though our knowledge is such as yet, that we are unable to analyze precisely the operation of the causal sequence in any individual case.

Having established the validity of the causal concept as such,

the next question is how it should be interpreted. The basic issue here concerns the rival points of view of mechanism and teleology. The former is satisfied with a purely physical explanation in terms of mechanical laws of cause and effect; the latter is primarily concerned with purposiveness and design which is achieved by an appropriate arrangement of means and ends.

The mechanist emphasizes the notion of determinism or the invariant relation between cause and effect. If he is also a materialist, he recognizes no other substance except matter and is convinced that even highly complex content of subjects such as biology, psychology, and the social sciences can be fully explained on the basis of the laws governing matter, without resorting to non-physical entities such as souls, vital principles or entelechies that are not subject to empirical investigation.

There is now a tremendous amount of evidence in favor of the mechanist explanation in most fields of study, though this evidence is not conclusive in areas such as biology and psychology. Nevertheless, the mechanist is confident that if his position is not yet proved decisively, this is due only to our incomplete knowledge, and not to the fact that certain phenomena do not per se lend themselves to mechanistic explanation. He is correct in maintaining that if biology and psychology are going to be considered as sciences in the true sense of the term, then their content must include only physically verifiable elements whose manifestations can be predicted according to invariable laws.

The teleogist view is chiefly based on the argument from design. It is claimed that nature abundantly illustrates the fitting adaptation of means to ends. By and large this is true. However, the argument is not conclusive because however wonderful the design might be, it is in many instances manifestly imperfect.

The alleged incompatibility between mechanism and teleology is based on a number of misconceptions. One of these is that determinism applies only to mechanism. Actually there is no a priori reason why teleological causes cannot be deterministic. Similarly, indeterminism does not necessarily indicate teleology, as in the case of electrons.

A mechanistic explanation of an event certainly does not preclude a teleological interpretation. An animal's behavior in its adaptation to its environment may be described as purposive. The same behavior might also adequately be explained in terms of scientific laws of physiology and chemistry. Mechanism and teleology are not mutually exclusive, but complementary. The conflict arises when the mechanist insists that the teleogist has no right to his interpretation. The conflict is intensified when the teleological interpretation endeavors to take the place of the causal explanation.

Our discussion would seem to indicate that the principle of causality continues to be an essential constituent of our epistemology in both philosophy and applied science. Quantum mechanics would seem to prove that it is not applicable to microscopic physics, but this has no decisive bearing upon the validity of the principle of causality with respect to macroscopic phenomena.

BIBLIOGRAPHY

- Ayer, A.J. The Foundations of Empirical Knowledge,
Macmillan and Co. Ltd., London, 1940
- Ayer, A.J. and Winch, R. British Empirical Philosophers,
Routledge and Kegan Paul Ltd., 1952
- Bergson, H. Creative Evolution, Translated by A. Mitchell,
Henry Hob and Company, 1911
- Billings, E.G. Handbook of Elementary Psychobiology & Psychiatry,
The Macmillan Co. Ltd., New York, 1939
- Bridgman, P.W. The Logic of Modern Physics,
The Macmillan Co. Ltd., New York, 1927
- Brill, G.A. Psychoanalysis,
Phil. Saunders, Second Edition, 1914
- Broad, C.D. Mind And Its Place In Nature,
Kegan Paul, London, 1925
- Burt, E.A. The Metaphysical Foundations of Modern Science,
Kegan Paul, London, 1925
- Burt, E.A. The English Philosophers From Bacon to Mill,
Random House Inc., New York, 1939
- Cameron, D.E. Objective and Experimental Psychiatry,
The Macmillan Co. Ltd., New York, 1941
- Cohen, M.R. Reason and Nature,
Harcourt, New York, 1931
- Collingwood, R.G. Philosophical Essays, Volume 2,
Clarendon Press, Oxford, 1940
- D'Abro, A. The Decline of Mechanism (In Modern Physics),
D. Van Nostrand Company, Inc., 1939
- Diethelm, Treatment in Psychiatry,
The Macmillan Co. Ltd., New York, 1936
- Descartes, R. A Discourse on Method,
J.M. Dent & Sons Ltd., London,

- Durant, W. The Story of Philosophy,
Pocket Books, Inc., New York, 1953
- Eddington, A. The Nature of the Physical World,
J.M.Dent & Sons, London, 1935
- Ewing, A.C. Idealism: A Critical Survey,
Methuen & Co. Ltd., London, 1934
- Ewing, A.C. A Short Commentary on Kant's Critique of Pure Reason,
Methuen & Co. Ltd., London, 1938
- Griffith, General Introduction to Psychology,
The Macmillan Co. Ltd., New York, 1929
- Hume, D. A Treatise of Human Nature, Volume 1,
J.M. Dent & Sons Ltd., London, 1949
- Jeans, J. The Mysterious Universe,
Cambridge University Press, 1931
- Joad, C.E.M. Philosophical Aspects of Modern Science,
Allen & Unwin, London, 1934
- King, C.D. The Psychology of Consciousness,
Kegan Paul, London, 1932
- Laing, B.M. David Hume,
Ernest Benn Limited, 1932
- Landis and Bølles, The Textbook of Abnormal Psychology,
The Macmillan Co. Ltd., New York, 1946
- Lange, History of Materialism, Volume 2,
Kegan Paul, London, 1892
- Macnabb, D.G.G. David Hume, His Theory of Knowledge and Morality,
Hutchinson's University Library, 1951
- Margenau, H. The Nature of Physical Reality,
McGraw Hill Book Company, Inc., New York, 1950
- Meredith, J.C. Kant's Critique of Judgment,
Oxford at the Clarendon Press, 1952
- Molesworth, Hobbes,
John Bohn, London, MDCCCXXXIX

- Orr, J. David Hume,
T. & T. Clark, 1903
- Passmore, J.A. Hume's Intentions,
Cambridge University Press, 1952
- Paton, J. Kant's Metaphysic of Experience,
George Allen & Unwin Ltd., London, 1936
- Planck, M. Where is Science Going?
Allen & Unwin, London, 1933
- Ratner, The Philosophy of Dewey,
Holt, New York, 1928
- Russell, B. A History of Western Philosophy,
Simon & Schuster, New York, 1945
- Russell, B. An Outline of Philosophy,
Allen, London, 1927
- Russell, B. Human Knowledge, Its Scope and Limits,
G. Allen, London, 1948
- Russell, B. Our Knowledge of the External World,
Open Court Publishing Co., 1914
- Ryle, G. The Concept of Mind,
Hutchinson's University Library, 1949
- Sellars, R.W. Evolutionary Naturalism,
Open Court Publishing Co., 1922
- Sheen, F. The Philosophy of Science,
Bruce Publishing Co., Milwaukee, 1934
- Smith, J.A. & Ross, W.D. Works of Aristotle,
Clarendon Press, Oxford, 1910
- Smith, N.K. The Philosophy of David Hume,
Macmillan and Co. Ltd., 1949
- Strecher, Ebaugh, Ewalt, Practical Clinical Psychiatry,
Blakiston, Philadelphia, 1951
- Stebbing, Philosophy and the Physicists,
Methuen & Co. Ltd., London, 1937

- Taylor, F.S. A Short History of Science,
Heinemann, London, 1939
- Tennant, F.R. Philosophy of the Sciences,
Cambridge University Press, 1932
- Toulmin, S. The Philosophy of Science,
Hutchinson's University Library, 1953
- Von Hartmann, Philosophy of the Unconscious,
Kegan Paul, London, 1931
- Watson, J. Kant,
J. Maclehose & Sons, Glasgow, 1908
- Whitehead, Process and Reality,
Cambridge University Press, 1929
- Whiteley, C.H. An Introduction to Metaphysics,
Methuen & Co. Ltd., London, 1950
- Windelband, U. A History of Ancient Philosophy,
Scribner's Sons, 1910
- Zeller, Aristotle and the Earlier Peripatetics,
Longmans, Green & Co., 1897

